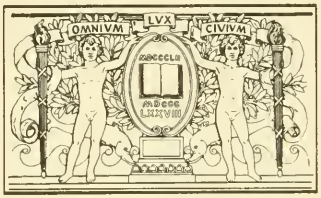
BOSTON PUBLIC LIBRARY
3 9999 06316 598 7



BOSTON
PUBLIC
LIBRARY

REPORT OF

HIGHWAY TRAFFIC RESEARCH

STATE & NUMBERED ROUTES MASSACHUSETTS

JUNE 1936 - DEC. 1937

PREPARED BY

HIGHWAY TRAFFIC RESEARCH

STATE WIDE W.P.A. PROJECT 165-14-6999

COMMONWEALTH PIER

BOSTON - MASS.

SPONSORED BY

MASSACHUSETTS DEPARTMENT OF PUBLIC SAFETY

A REPORT OF THE

ORIGIN
DEVELOPMENT - OPERATION
FINDINGS - CONCLUSIONS - RECOMMENDATIONS
EXHIBITS

of the

H I G H W A Y T R A F F I C R E S E A R C H

June 1, 1936 to December 8, 1937

Prepared By
HIGHWAY TRAFFIC RESEARCH
STATE WIDE WPA PROJECT 165-14-6999
COMMONWEALTH PIER
BOSTON - MASS.

John M. Moorhead - Project Director
Chester C. Rausch - Chief Engineer
Arthur E. Pecker - Analyst

Sponsored By
MASSACHUSETTS DEPARTMENT OF PUBLIC SAFETY

Paul G. Kirk - Commissioner
Capt. James P. Mahoney - State Police Executive Officer

* HE356
.M4U5
1937
Copy 2

BOSTON PUBLIC LIBRARY

Anon Gift
July 17-1963

N O T E

This report is intended to serve three purposes: First, to explain the origin and development of the project and its operation. Second, to set forth in detail its findings and recommendations. Third, to show some exhibits typical of its work. With these facts in mind, and by proper use of the Table of Contents, the reader can locate quickly that portion of immediate interest to him.

SECTION ONE Indicates the origin of the project, the problem as to the work existing and why certain operations were selected or changed. Then follows a description of the various divisions set up to achieve the results sought, of the methods and equipment used and of the distribution of the personnel to accomplish these results.

SECTION TWO Reports a synopsis of the various facts found, the problems encountered, the conclusions drawn, and the recommendations or suggestions offered as a result of the best interpretation derived from the experience of the project. This section is devoid of any description of operating technique intended to be covered in Section One.

SECTION THREE Contains only exhibits selected from the many available, to show the features now used and deemed to be of value to the project or to whatever group may assume such, or like, duties hereafter. Aside from those typical exhibits shown, there are on file more than one hundred monographs or reports on special subjects involved with the survey, as well as of the forms and records developed and abandoned in favor of those now used.

It is anticipated that those who find this report helpful will apply for such records, data and other material and forms as they believe will aid them in their work.

F O R E W O R D

The Highway Traffic Research is unique in many respects. It was bequeathed a miscellaneous heritage in October 1934 from its predecessor, the Massachusetts Highway Accident Survey, which had plowed an unknown field.

The work of the Highway Traffic Research involved further pioneering in an area larger than had ever before been covered in so comprehensive a traffic survey. The work of the project from October 1934 to June 1936 has been previously published. This report covers operations from June 1936 to December 1937.

Concentrating only on the State and Numbered highways, its findings and recommendations have value because the unit to which its efforts were confined is definite and recognizable. The eighteen months of operation, covered by this report, added to the twenty-one months covered in the previous report, with a personnel consisting largely of experienced, older and trained men, removed the objections to short-time studies.

Those responsible for the development and operation, and the conclusions and recommendations herein presented, do so with the feeling that they present a concise and carefully executed piece of work of value to the sponsor, the Works Progress Administration and to any others concerned with reducing death and injury on the highways of this, or of any other comparable area.

TABLE OF CONTENTS

SECTION ONE

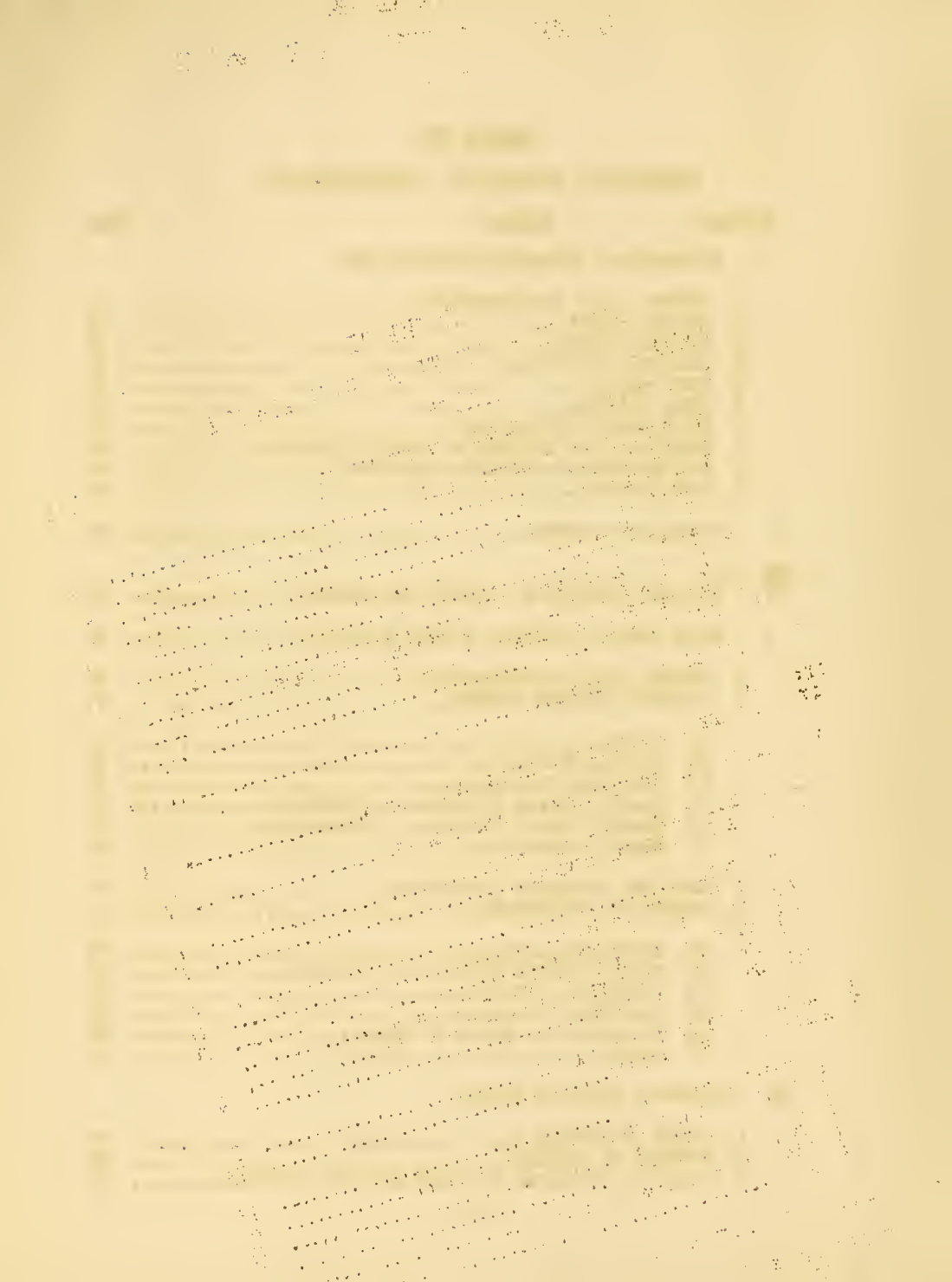
ORIGIN - DEVELOPMENT - OPERATION

Division	Subject	Page
1	ORIGIN, PURPOSE AND POLICIES	1
2	NATURE OF PROBLEM	2
3	OPERATIONS ADOPTED	3
4	OPERATIONS DEFINED	4
	(a) Area Covered	4
	(b) Operating Sub-Divisions	5
	(c) Time Covered	5
	(d) Control Medium	5
	(e) Nature of Supporting Observations	6
	(f) Strip Maps	6
	(g) Site Code Maps	7
	(h) Accident Records - How Taken	8
	(i) Accident Records - How Bound	10
	(j) Patrol Maps and Tables and Schedule	10
	(k) Field Studies	23
	(l) Field Study Forms	24
	(m) Mobile Crew - Open Highway Studies	26
	(n) Mobile Crew Speed Records	28
	(o) Hazardous Location Studies	28
	(p) Town Reports	30
	(q) Miscellaneous Factual Data	30
	(r) Lectures	31
	(s) Files and Records	31
	(t) Routine Office Methods and Equipment	32
5	OPERATIONS AND ADMINISTRATION	33
	(a) Supervisor	33
	(b) Manager	33
	(c) Accounting - Timekeeping - Purchasing	34
	(d) Analysis Division	34
	(e) Computing Division	35
	(f) Drafting Division	35
	(g) Printing, Binding, and Filing Division	35
	(h) Mobile Crew - Boston Office	35
	(i) Mobile Crew - Field	35
	(j) Field Crews - Motor Traffic Violation	36

SECTION TWO

DEDUCTIONS - CONCLUSIONS - RECOMMENDATIONS

Division	Subject	Page
I	FUNDAMENTALS CONTROLLING SECTION TWO	
1	GENERAL BASIC CONSIDERATIONS	37
2	PROBLEM STATED	38
3	ACCIDENT RECORDS	38
4	SEASONAL CONDITIONS	38
5	TROOP AREAS	39
6	AREAS OMITTED	39
7	MOTOR TRAFFIC VIOLATIONS	40
8	CORRELATION OF ACCIDENT & VIOLATION RECORDS	40
9	POLICE-REPORTED HAZARDOUS LOCATIONS	40
10	TOWN REPORTS	41
II	DIVISIONS OF REPORT	41
III and IV	ACCIDENT STATISTICS - TABLES AND CHARTS	43
V	MOTOR TRAFFIC VIOLATION RECORD ANALYSIS	70
1	GENERAL BASIC CONSIDERATIONS	70
2	VIOLATION STUDIES COVERED	71
	(a) Volume	71
	(b) Driving Violations	71
	(c) Stop Sign Observance	71
	(d) Traffic Signal Violations - Vehicular	71
	(e) Traffic Signal Violations - Pedestrian	72
	(f) Speed Observations	72
3	BASIS FOR VIOLATION COMPARISONS	72
4	ANALYSIS OF VIOLATIONS	73
	(a) Driving Violations	73
	(b) Traffic Signal Violations - Vehicular	75
	(c) Pedestrian Violations	77
	(d) Stop Sign Violations	78
	(e) Violations by Number of Lanes	80
	(f) Speed	81
VI	HAZARDOUS LOCATION STUDIES	
1	ORIGIN OF PROBLEM	82
2	APPROACH TO PROBLEM	83
3	LOCATIONS INDICATED BY POLICE AND TOWN OFFICIALS	83



Division	Subject	Page
VII	MOBILE SPEED STUDIES	84
VIII	GENERAL SUMMARY AND CONCLUSIONS	118

SECTION THREE

EXHIBITS

Division	Subject	Page
I	SELECTION OF EXHIBITS	122
II	NATURE AND ARRANGEMENT	122
III	DESCRIPTION	122

	Exhibit
ORGANIZATION CHART	1
TRAFFIC REGULATIONS - CITIES & TOWNS (Compared with Proposed Code)	2
ACCIDENT SPOT MAP - MASSACHUSETTS	3
ACCIDENT RATING MAP - ONE MILE BLOCKS FOR GENERAL USE	4
ACCIDENT RATING MAP - ONE MILE BLOCKS FOR STATE POLICE USE	5
BASIC STRIP MAPS - PREPARATION & REPRODUCTION	6
BASIC STRIP MAPS - ORIGINAL FOUNDATION MAP	7
BASIC STRIP MAPS - ACCIDENT SPOT MAP	8
BASIC STRIP MAPS - RECOMMENDED SPEEDS	9
BASIC STRIP MAPS - HIGHWAY SPEED STUDIES	10
SITE CODE MAP	11
LOCATION SHEET - FOR FIELD STUDIES	12
FIELD STUDY - TALLY SHEETS	13-19
FIELD STUDY - SUMMARY SHEETS	20-26
FIELD STUDY - OFFICE RECORDS	27-28
FIELD STUDY - CORRELATION SHEETS	29-34
ACCIDENT REPORT FORM	35

S E C T I O N O N E

OF THE REPORT OF

T H E H I G H W A Y T R A F F I C R E S E A R C H

COVERING ITS

O R I G I N - D E V E L O P M E N T - O P E R A T I O N

JUNE 1, 1936 to DECEMBER 8, 1937

1. ORIGIN, PURPOSE AND POLICIES

The Highway Traffic Research, under the sponsorship of the Massachusetts Department of Public Safety (hereinafter referred to as the Sponsor), began its activities under this designation in October 1934. It was, to some extent, a continuation of the original, state-wide, highway accident study begun under the Massachusetts Highway Accident Survey which ended in August 1934. A report has been published covering our activities from October 1934 to June 1936. This report covers the period from June 1, 1936 to December 8, 1937.

Our problem was essentially the same as it had been in the past, and the same general line of procedure was adopted:

(a) To determine what activities of the preceding survey should be retained in the present survey and what additional work, if any, should be attempted to supplement these retentions.

(b) To economically and efficiently utilize a minimum personnel in such a manner as to provide the WPA and the Sponsor with such factual data and information as may be desired.

(c) To confine this work solely to the State and Numbered highways as a means for identifying our activities, keeping within the scope of the project and covering those highways largely of interest to the Sponsor.

(2) NATURE OF THE PROBLEM

There are over 24,182 miles of highway in the towns and cities of the State, of which 1826 are State controlled highways and 1483 Numbered highways jointly controlled by State and municipal authorities, a total of 3309 miles, of 13.7% of the total highway mileage.

The area covered by our studies was responsible in 1935 for 37.7% of the fatalities, 27.2% of all injuries, and 28.1% of all motor vehicle accidents in the State. In 1937 this same area was responsible for 34.4% of the fatalities, 30.6% of the injuries, and 31.4% of all motor vehicle accidents which occurred in Massachusetts. The task was thus identified and the project kept within such reasonable limits as were necessary to thoroughly study this single group of highways with complete thoroughness.

Prior to starting any operations, an effort was made to determine what the sponsor both desired to know and required concerning these highways. A careful study indicated the following to be its most vital needs:

(a) The sponsor desired a segregation and arrangement of the records of those accidents reported by the police as occurring on the State highways. These records to be in such form as to show accident trends at specific locations.

(b) There are 3309 miles of State or Numbered highways in Massachusetts jointly controlled by State and municipal authorities. The State Police, who are responsible for patrolling over 60% of this mileage, desired detailed road maps of their responsible areas.

(c) The sponsor desired accurate records of actual highway speeds at critical locations. These records were to be based on observations of a sufficient number of vehicles for a long enough period, and at different times, to provide a reliable report on the existing traffic pace.

(d) A record of Motor Traffic Violations occurring at points of high accident frequency or accident-prone locations in order to provide means of ascertaining the correlation between violations and accidents.

3 OPERATIONS ADOPTED

Based on these fundamental desires a line of project operation was adopted and has been continued which gives the information as to where the hazards existed, of what nature these consisted, and when the bulk of accidents happened; then to operate project activities only to the extent essential to secure basic facts and data to supply these needs.

For this purpose the following operations were planned to be carried into effect, during a period twelve months in advance, as a minimum necessary to secure reliable data for comparison and to work out, during this same period, or during any extension the technique of a sound operation to obtain these essentials.

(a) To obtain a record, with all facts essential to a complete knowledge of the causes, the time, the number killed and injured, and the extent of property damage in accidents reported or handled by the State Police, Local Police and Metropolitan District Commission Police on the State and Numbered highways.

(b) To locate isolated accident-prone spots, or locations having a high accident rate, particularly those with high death and injury rates, based on the original police records of accidents.

(c) To locate one-mile stretches of road as a controllable unit which might, or might not, include one or more spots of high accident frequency.

(d) To observe and study the Motor Traffic Violations at locations of an accident-prone nature, to determine what actions or violations of traffic regulations were contributory to reported accidents.

(e) To further analyze items (a) accident records and (d) motor traffic violation records for such locations as were studied, to determine what was responsible for accidents and supply this information to the sponsor and other interested parties.

(f) To provide reports and analyses for the sponsor, based on the gathered facts, both as an aid for current information and to indicate to him the trends of accidents, their increase or decrease at specific locations in troop areas and towns and, in addition, to disseminate this information to proper enforcement officials for their use and guidance.

(g) To provide the sponsor with diagrams, maps, charts, and indicators developed as a means of graphic portrayal of this information and to reduce tabulated facts and records to visible and easily used devices readily kept current for daily use.

(h) To keep these records and devices up to date by periodic, semi-annual, quarterly or monthly recordings, as may be required, to make them effective as a working, and workable unit.

(i) To revise, alter and reconstruct all records and methods for recording and exhibiting data and information, based on cumulative experience, to the end that lost motion shall be reduced, simplicity and clarity retained and the equipment brought to as near perfection for the use intended as is possible while looking forward to the eventual use of this equipment by the sponsor. The sponsor required only essential facts, kept current and accurate and graphically put down, for constant reference and ready understanding by men accustomed to action.

4 OPERATIONS DEFINED

When these basic requirements had become evident, and the decision made to apply the effort of the project to these functions only, and to their perfection, the mechanical equipment and operations were designed along the following lines, namely:

(a) Area Covered - All records, both accident and motor traffic violation, were taken on or apply only to the 3309 miles of State and Numbered highways, those generally spoken of as "State Highways".

(a) Area Covered Cont'd. - For the first time so far as known, a specific group of roads has been studied intensively over a considerable area (Massachusetts) where they are under virtually uniform, legal, traffic conditions, barring, of course, purely local regulation in towns and cities.

(b) Operating Sub-Divisions - The State was divided into four operating areas, the limits of which were the official Troop Areas A, B, C, and D used by the sponsor. This enabled proper control of field work and presented the facts for such areas in the manner required by the sponsor. Such division in no way hampered its use for other general purposes. Where essential for the operations of the sponsor, sub-divisions of the Troop Areas were made into Sub-Station or Barracks areas.

(c) Time Covered - During the nineteen months included between June 1, 1936 and December 1,1937, the Highway Traffic Research has employed from 110 maximum on June 1, 1936 to 44 minimum in November 1937. Of this number ordinarily 60 to 65 percent are employed in the field in connection with recording data on accidents and driver behavior, the balance in computing, analyzing and correlating this data, and in administration, in the Boston Office. During this period, other than on National holidays, there has been no day of the week on which some of the project were not at work, either in the field or office. All field work was discontinued in September 1937.

(d) Control Medium - At the very outset it became necessary to determine what criterion was to be used to focus our activities at spots to be studied. Two avenues were open; determination by volume and determination by accident record.

Volume records are open to a variety of interpretations and wide, seasonal fluctuations. Accident records covering killed, injured and property damage are reasonably definite. Since our purpose was to aid in the reduction of accidents, these were adopted on two broad, general premises; first, where accidents occur there will be some predisposing cause, due to the location itself, and second, regardless of traffic volume, an accident-prone location demands attention. This general attitude, on which our work was established, our records kept and our conclusions drawn should be kept in mind in reading the balance of this report.

(e) Nature of Supporting Observations - For the purpose of studying motor traffic violations, field crews have observed 8,970,702 vehicles and studied 788 different sites. We have studied 306 towns from June 1936 to December 1937, of which number 9 were towns not previously studied. Since the inception of this project in October 1934 we have studied a total of 21,115,226 vehicles at 1388 sites in 249 towns.

In addition to the specific field crew studies, the Mobile Speed Unit has covered speed at 71 different locations, from June 1, 1936 to December 31, 1936. Total studies were made by this group of 684 locations on 36 different routes, almost entirely east of the Connecticut River and north of the Cape Cod Canal, since the work was started in October 1934.

(f) Strip Maps - As a basis for portraying the routes to be covered under the scope of the work, no maps suitable for such a purpose being in existence, a set of maps, designated as "Strip Maps", and hereafter referred to as such, covering 3309 miles of State and numbered routes was prepared in panels 12" x 24" on a scale 2" to one mile (except where congested areas in cities called for larger scale). These maps were diagrammatic only, since they were not to be used for engineering purposes, and contained the approximate shape of the routes in plan and indicated towns and troop area boundaries, the intersecting routes, all intersecting public ways (with names), bridges and important landmarks. Distances to the route intersection points and town lines were given from the route origin as a means for securing approximate location distances on the route. These distances, witnessed by letters on the route, were tabulated in the map margin.

The strip maps were prepared in pencil on tracing paper from a heterogeneous lot of town, county and other maps gathered from State, municipal and other sources, or by purchase. The amount of work involved in securing these maps and the correlation of this data into strip maps, was tremendous. No single complete set became available from any of the numerous State divisions where searches were made. Months were involved in this fundamental work and called for an enormous amount of searches and checking from one map to another.

(f) When completed in pencil the maps were then taken over the actual route by the field crews, and then checked for distance, location, names of streets and other features.

When returned, thus revised, they were inked. Four subsequent operations used these maps, by proper reproduction methods, as a basis for presenting all other data used in our work where route maps were required.

Bound separately in volumes, these maps provide an atlas for constant reference in the sponsor's headquarters and in troop and barracks areas. Twenty-three sets are required, each set containing those maps appropriate only to any particular area covered by such barracks.

(g) Site Code Maps - Each hazardous location studied by a field crew was given a code number consisting of the troop area letter with the identifying number always assigned to the site. All records for that site thereafter always bore that number. The route number on which the site occurs and the town through which the route passes also appears. The exact location is further given in miles and tenths of miles from the nearest town line or route intersection.

For each site a detailed map 8½" x 11" is drawn and for such a site the code number appears on the strip maps at its proper location to tie the site map to the route map. This enables quick reference to the book of site code maps by their numerical arrangement in their own volume or to refer a coded site to its location on a route. *

Both strip and site code maps are valuable in establishing and exhibiting facts used in accident reports and in court evidence, as well as for general reference use. The site code maps, as well as the strip maps, when once completed, require only occasional revision.

* Such maps show the details of road surface, lane markings, signs, fences, poles, trees, hydrants and such off route features as buildings, banking, side and property entrances or other features the presence of which affects traffic either on, entering or leaving the route.

(h) Accident Records - How Taken - In 1936 there were 11,734 accidents and in 1937 there were 13,335 accidents on the 3309 miles of State and numbered routes involving death, injury, or property damage only. Accidents on the portion of such routes covered by State Police, and reported by them, were reported directly to the project without further efforts. These represent about 12% of the total of all accidents on such routes.

The remainder were gathered quarterly from the police records of such places as reported route accidents. This includes 265 towns and cities (excepting only Boston, Worcester and Springfield) in 1936 and 1937. They were copied directly from police blotters by members of our organization. In some cases these accidents were segregated on the police records, in others they had to be weeded out from all other crime records and the causes and other facts deduced from reading the actual report entered at the time of the accident. An average of 135 man days was required each three months to do this work. In 1936 and 1937 the M. D. C. Police reports were also gathered.

Careful consideration of the experience with this work to date shows the records should be taken quarterly to make them comparable by seasons, as well as to put the information thus obtained more quickly into the hands of the sponsor for effective use in enforcement. Moreover, experienced men can be retained on the work at a considerable saving in time and mileage and with the possibility of fewer errors. Furthermore, the local police chiefs prefer to have the same men come every quarter, and we feel decidedly that this should be done, in consideration of the fact that the police are extending us a courtesy as they are under no obligation to furnish us with these reports. Such a plan was put into operation at the end of the Spring quarter of 1936 and has been continued through 1937. Any deviation from this plan we feel would be a grave mistake.

These accidents are tabulated as to location, time of day, of week, and of month, results as to killed, injured and property damage, peak

(h) Accident Records - How Taken - Cont'd. - hours, fatalities during daylight and after dark, nature of vehicles involved, type of accident, road and weather conditions, nature of traffic control at site, whether adult or child if pedestrian, eleven major causes, and six items covering the nature, age, etc., of driver involved. The form used is shown in Section Three.

By proper tabulating and correlation of these details by entire routes, mile-stretches of such routes, and by towns or areas, details can be reported and proper determination of trends of change toward better or worse conditions discovered from several points of view. The almost total lack of any record of directional movements of vehicles involved in accidents recorded in Local Police records prevents the preparation of collision diagrams without the expenditure of a vast amount of time for reading questionable or biased accounts of such accidents. No appreciable gain for the sponsor's purposes was found where this was tried experimentally. To attempt to make collision diagrams without accurate and sufficient data would be foolish as well as misleading.

Further study of the method of recording and interpreting will enable us, as our work progresses, to obtain even more value from this work, by comparison of trends over longer periods. It does, however, admirably serve its immediate purpose of bringing to attention the accident-prone spots with the facts pertinent to them.

For purposes of reference, and as a convenience to the sponsor, the accident records were kept in two units, those reported by the State Police, the records of which are copied directly by our staff from the records in the Department of Public Safety (whose office adjoins that of this project) and those copied by our field staff from the records of the Local Police, M. D..C. Police or reporting officer.

It should be noted that the records kept by the State Police are accurate, complete and uniform for the State through the regular use of a form adopted for the purposes.

(i) Accident Records - How Bound — For our purposes there was developed a form (see Section Three) containing such information as is generally deemed essential for our studies and as was normally available in the various cities and towns for inclusion therein. This form was arranged for convenience in use and printed by hectograph so that when each three month's record was complete it could be bound in boards and linen as a permanent work of reference by police chiefs and others desiring such information. The cost was negligible for labor and paper, and worth much in good will and co-operation in securing later records.

Records were first compiled and bound semi-annually from January 1935. Beginning January 1936 they were taken and analyzed each quarter and bound on a quarterly basis. The information was found to be so vital to many units that this step became necessary. By proper mechanical steps both time and paper required were materially reduced on quarterly binding.

State and Local records are each bound separately, to accomodate the sponsor's needs, but for general use and comparison the combined State and Local reported records are generally used. This was necessary because, of the total accidents recorded as occurring on State and Numbered highways, only 14% approximately, were reported in 1935, 13.6% in 1936, and 12% in 1937 by the State Police.

(j) Patrol Maps and Tables - When the first six month's record of accidents on the State and Numbered highways had been gathered they were checked and then tabulated. In this form the records, although adapted to most purposes, did not lend themselves particularly well to a quick rendering of the gathered facts to those patrol officers responsible for applying this information to the patrolled routes.

(j) Patrol Maps and Tables Cont'd. - To remove this difficulty the State was divided into the four Troop Areas, a simple outline map of the routes in each area was made and each route divided into mile stretches identical with those on the Accident Spot Maps. These mile stretches were then rated so that by a quick examination from this patrol map an officer could gather the facts pertaining to those miles which had been assigned to him for patrol duty.

Ratings for these mile-stretches were based on units adopted by insurance companies as indicating the proportionate, unit costs of settled accident claims, i. e., a death, represented five units, a personal injury two, and a property damage one unit. This was an arbitrary basis found, when applied to accident data used by us, to admirably show the accident density.

When the total density of the accidents which happened in any mile-stretch, thus weighted, added to more than ten, the mile was rated as a "Number One Mile", when between ten and five as a "Number Two Mile", and when under five as a "Number Three Mile". Any mile rated as a "Number One Mile" was immediately given attention. Our records of sites previously studied were examined for behavior and speed, and these compared with the actual accidents, or, if no study had previously been made at a site in which numerous accidents were currently reported, then a behavior study was ordered for the locations where accident severity was currently high.

In this fashion the change in rating by semi-annual records, and now by quarterly records, indicated whether or not such miles and the locations in these miles, were generally showing more, or fewer, accidents and thus automatically put such mile-stretches on the list for active attention or permitted the effort then assigned to such mile-stretches to be placed where accidents and violations had increased.

(j) Patrol Maps and Tables Cont'd - This proved to be a logical, practical and definite means for assigning road patrol men where they would be most effective and, in practice, only called for an adjustment of hours for patrol, based on peak accident and volume conditions to permit its effective use.

A later refinement eliminated all mile stretch records on the sponsor's patrol map, excepting for "Number One Miles". For these miles the data was affixed as a fraction, the numerator of which gave the total accidents for the preceding accident-record period and the denominator, the deaths during such periods. The complete one, two, three mile record was first prepared to reveal the conditions throughout the State; the simplified form was prepared for the patrol work of the sponsor.

This style of patrol schedule was discontinued with the last quarter of 1936, as a better plan had been devised. Effective January 1937 the following plan was put into operation, has worked successfully, and until further improvements can be made, will be used as the basis for patrol purposes.

PATROL BASIS

Several elements have been taken into consideration in setting up the schedule and as the basis for its use.

(1) A definite, easily recognized unit of highway, one mile long, for use in studying and for assigning the portion of the highway to be patrolled - the one mile block.

(2) The four quarters covering the nearest, full, twelve months for which the accident records are complete - the fiscal year.

(3) A record of, and a breakdown of, the accidents for this fiscal year into killed, injured and property damage only - the accident record.

(4) A means for rating a mile block in order to measure its proneness to accidents for definite periods - the accident percentage - hereinafter called the accident rating.

(5) A record of the time when accidents happened, as a basis upon which to determine the period where patrol effort should be concentrated - the time schedule.

(6) A means for indicating particularly bad spots in a given mile - the spotted locations.

PURPOSE OF THE PATROL UNITS

The several units above listed give the necessary information from which to plan ahead and to lay out a schedule for patrol to fit the conditions liable to be encountered, so far as can be done by using previous records for the purpose. The following explanation shows both the first purpose of the different groups of facts and other uses to which these facts can be put for the purpose of treating the entire road patrol under an organized plan aimed to reduce traffic violations, and hence deaths and injuries, on the State and Numbered Routes of Massachusetts.

(1) One Mile Block - The portion of each such route within the limits of a town has been divided into one mile blocks for two reasons, it gives a convenient means for assigning patrol duties and recording the units of work done by patrolmen, and it offers the smallest, practical unit of area within which accidents can be grouped.

It may not be a perfect method and, when put to use, probably will reveal faults which can be corrected in later quarters based on experience. It has, however, been found workable for other purposes and has been adopted for patrol purposes for the same reason.

These mile blocks are numbered on each route beginning at the north end of the route and going south, or at the east end and going west. If the last block in a town is less than one-half a mile in length it is thrown into the preceding, lower numbered block; if over one-half and under one mile it is considered as a mile block and given a number. On all Route Strip Maps these mile blocks are

indicated by arrows pointing to that place on the route where the mile block begins and ends.

This eventually will enable ready comparisons either of the work assigned or the results obtained, on a section of a route heretofore patrolled, where such a section was previously designated by local streets or other names, and hereafter may be designated by such definitely numbered miles. This greatly simplifies patrolled mileage for record purposes.

It will also be found that the accident totals, or the accident rating hereinafter described for these mile-blocks, can be added together for any portion, or all, of a route and divided by the total number of such blocks. The result will give a figure which can be used to indicate the accident rate per mile, or, if the accident ratings (which see below) are used, measure the severity per mile for a desired quarter in the fiscal year.

A proper use of this method, as time goes on, should show whether any real improvements are being made as a result of patrol effort as well as where sections patrolled can be dropped and other sections added. This was one of the secondary considerations in adopting this unit for measuring the routes covered.

(2) Fiscal Year - In determining the length of a period long enough to give a reasonably proportioned picture of the accident record and tendencies, in any single, one mile block, a year was considered to be long enough because it reflected the changes in weather, of density of travel, the effect of daylight-saving, school and vacation traffic and other features varying with the seasons.

The use of a calendar year was abandoned because its record , as time went on, gave less and less a true reflection both of actual accident conditions created by the most recent traffic and of the effect of enforcement, before another calendar year's record could be made available.

Local, State and M. D. C. Police reported accidents are used, including those involving property damage only. Property damage accidents are more serious accidents avoided only by mere chance.

In the normal course of events it takes about one calendar quarter of three months, or from sixty to ninety days to gather, check and compile the local, police-recorded, accident records for the preceding quarter for combination with the accidents reported by the State Police for the same period.

This means, in substance, that in laying out a Patrol Schedule for January, February and March, the latest complete records end at the preceding September thirtieth. As at present organized, record taking time cannot be materially shortened.

The fiscal year, in the manner used here, will regularly be exactly three months behind the quarter for which the Patrol Schedule is prepared in advance. The records will, therefore, include the last quarter period for which records have been completed and extend back to include the three, quarter-periods immediately preceding, thus forming the fiscal year of four full quarters.

This method constantly drops an old quarter, and adds a new quarter to the fiscal year, as each new Patrol Schedule is prepared.

By this means the records are sufficiently near the quarter on which the Patrol Schedule is based and makes it reflect any changes in local conditions covering any decrease or increase in accidents. It will thus indicate with reasonable promptness, the need for less, or more, patrol as conditions warrant. A calendar year does not offer this feature. Such a year is fixed, not movable. Finally, it may be a full year behind actual conditions.

Note that a Patrol Schedule is prepared in advance with the idea that through its use the most recent accident record of an identical quarter period is used to forecast, as nearly as can be done, about what type of accidents the future should be expected to give, and at what probable locations and times. This is more fully explained on page 16 under "Accident Rating".

(3) Accident Record - The accident record covering the fiscal year is shown in four items. First the total number of accidents of all kinds, shown under (No.) regardless of whether these accidents involved death, injury or property damage only. Second, the killed in those accidents shown under (K). Third, the injured shown under (J). Fourth, those accidents in which property damage only occurred shown under (P).

The purpose of this breakdown is to indicate the trend of the type of accidents that are happening. If the percentage of fatalities and injuries is high, then reckless or drunken driving, in its many aspects, is a natural presumption and should call for rigid enforcement against violations of this type.

If, on the other hand, property damage is high, it may indicate some disturbing local physical condition, either of a temporary or permanent nature, upsetting the easy and natural movement of vehicles.

The interpretation of these figures, if carefully examined, reveals much of what is taking place in the way of accidents on the highways. The time involved in such a study should enable any person responsible for organizing a highway patrol to know where the bad regions exist and what treatment is required. These records, aside from those in the attached schedule, now are available, on request, for a period of three years (covering State and Local Police records) for such supplementary comparisons as may be required in any area or on any routes.

(4) Accident Rating - A mere group of figures setting forth the number of motor vehicle accidents for a given piece of highway, when broken down into killed, injured and property damage groups, is not usually sufficient information upon which to base a patrol schedule. It requires the consideration of too many units and causes a confusion when used as a basis upon which to compare many miles of highway. However, if the total of all types of accidents (killed, injured and property damage) are combined into one figure for each mile, for any given period, it then becomes a relatively simple task, by comparing these totals, to secure a fair idea of the conditions that prevail on a route.

Based on these totals it is possible to set a figure, suited to any Troop Area or to any route above which it is deemed necessary to establish enforcement patrol or below which such patrol can temporarily be abandoned. While other factors as later explained, have their bearing, this method has been found to represent accident tendencies of a given area with sufficient accuracy.

Accident Ratings are shown as two entries against each mile, one entry covering a quarter (Qr.) in the preceding fiscal year corresponding with the one for which the current Patrol Schedule has been set up, and one entry covering a percentage (%) representing what part of the total, fiscal year accidents occurred in the corresponding quarter (Qr) in that fiscal year.

The reason for this method of rating is to show the accident loading for a given mile for the quarter based upon the nearest fiscal year for which records have been tabulated. For example, in setting up the Patrol Schedule for the first quarter of 1937 the accident record is given for a fiscal year composed of the last quarter of 1935 and the first three quarters of 1936, thus bringing the accident record up to include the last complete quarter available, namely, the quarter ending September 30, 1936.

Alongside this fiscal year accident record is placed the accident rating for the quarter, with its percentage for the first quarter of 1936, as a basis of what might normally be expected for the first quarter of 1937.

This method at once indicates how much of the accident record occurred in this particular quarter and gives a general idea of what to expect and plan for in the future in the mile block to which this pair of figures applies. It is obvious that if the accident record for a fiscal year stood at 100, and at 75 (equal to 75%) for a particular quarter corresponding to the one under consideration, that three-fourths of the entire accidents came in the same corresponding quarter the previous fiscal year that is now planned to be covered by the current schedule. It is, in effect, a diagnosis.

In the same manner, and on the same basis, mile after mile of a route can be compared either for the year or for the quarter. Moreover, as the schedules are issued and accumulate, quarter by quarter, these ratings show

the effect of patrol effort or of any other means applied to the reduction of accidents. It is believed that this means of displaying accident conditions will be far more accurate, more easily used and flexible than any maps. Such a use of these Patrol Schedules should cover at least four quarters of a year until any difficulties in set-up and manipulation are removed.

(5) Time Schedule - The several features of the Patrol Schedule set forth in (1) to (4) above give the facts pertaining to accidents and their location, but no indication as to when the patrol should be applied. It is obvious that for each mile, and in some cases, for certain sections of miles, the accidents will tend to come during definite periods in the day or on specific days of the week, due to the nature of the travel thereon.

The two time schedules are designed to reveal this information. Each accident, therefore, is put under the hour of the day and under the day of the week when it happened. Already they are grouped under three definite months of a quarter. Such time classifications require no further explanation since they largely explain themselves.

(6) Spotted Locations - In each mile there are apt to be locations where, for one reason or another, usually definite types of violations, an unusual number of accidents have appeared. If such locations occur in a given mile and any facts are available, in addition to the accident records themselves, sufficient to enable the person laying out the schedule to secure a more complete record of the causes of the accidents, or showing the necessity to concentrate on one or more locations in a given mile for specific violations, these facts will be placed on the back of each sheet, or even in special separate reports sent out with the schedule itself.

Each item is preceded by an identifying number in parenthesis. On the face of the same page this number will appear against the block to which it refers under the column headed "Spot". Facts covering the location will be sufficient to locate the spot definitely so that, in the assignment of a

patrol the officer will know exactly where an unusually bad spot is located and what type of violation to be alert to detect.

Proper use of this information should over a period, enable the elimination of "death" curves, intersections, hills and so forth, and other spots where severe accidents occur frequently. Moreover, if such enforcement still fails to reduce the accidents there is then sufficient reason to call for thorough study of the physical characteristics by competent and responsible authorities.

LIMITATIONS OF SCHEDULE

The foregoing items, Basis of Schedule and Purpose of Schedule, explain the basis upon which the facts in the schedule have been set up. Those who may be called upon to use these facts in selecting sections of highway to be patrolled and to assigning a limited number of men to this duty in a manner to secure the most efficient coverage, may find the following facts worth considering.

(1) The schedule, by and of itself, is not a final or complete solution - it is a convenient and accurate means for placing all the accident data compactly and quickly before the assignment officer.

(2) Each such local officer already has a complete knowledge of these routes and of the general behavior of drivers on such routes, both during congested traffic and under light traffic conditions.

(3) Each such officer has a plan for assigning patrol duty he is now using with satisfaction and with success. However, much of the information now for the first time placed at his disposal, should enable a more effective plan of operation due to an attack based on complete data.

(4) Like any suggestion for improvement of a going procedure, based upon additional facts, time is required to fit it into any previously used plan. Only by assuming a broad outlook, recognizing both the growing complexity of traffic control and giving the plan herein presented a fair trial can any real benefit be derived. The plan is presented with the belief that those with whom it is placed will give it such a trial and, as time reveals changes to make it

more effective, either by adding to it or taking from it what is no longer needed. Frankly offer their ideas to those at present concerned with its preparation.

(5) The entire mileage of the State and Numbered routes (a total of 3309 miles) has been scheduled, not with the idea that this is all to be patrolled but, first, that such miles as now are patrolled shall be covered in the most efficient manner; second, that through the records here presented, those responsible for patrol shall be able, through advance information not now available to them, to detect those roads which, by their record, eventually will call for patrol; third, that through the record of accident reduction these Patrol Schedules will show as time goes on that men can be removed either temporarily or permanently for new assignments.

USE OF THE SCHEDULE

The methods by which those who designed the schedule consider it can be more effectively used fall into the following steps. They are suggestive only.

(1) Scan the Rating Column, and against the column headed (%) and in the space immediately at the right made by the two parallel lines, enter near the top a check mark against those miles where more than, say for a beginning, twenty-five percent of the year's accidents are represented by the quarter. Experience may dictate a different percentage to be suited to a given Troop Area, or after the schedules for a number of quarters are on file, examination may suggest another percentage, either higher or lower. Time and trial only can determine.

(2) Run the mileage a second time and check those miles where the number of accidents appears to be high.

(3) Run the mileage of the given route a third time and check those miles (in the same checking space) where deaths have occurred or where the number of injuries is high compared with the number of accidents in the given mile block.

(4) Then, preferably with colored pencil, circle or block in those miles checked three times. It will

be found that given stretches of connected miles will appear calling for patrol. Compare this with the miles as now patrolled and consider adding those now marked under the Schedule and not now patrolled, or of abandoning those that do not appear at all.

(5) Scan the hours from midnight to midnight and circle, underline or check those groups of hours which appear to produce the burden of accidents.

(6) Scan the day columns and likewise circle or underline the three days most burdened with accidents.

(7) An examination of the sheet will now show certain miles blocked out as having a bad accident rating, and the mass of circled hours and days will throw this work into periods in which patrol should be placed.

(8) Stack this information against the general knowledge of volume and other facts now possessed by the assigning officer and a basis for patrol is reasonably and effectively set up.

(9) Schedule these miles for the officer, and if there be information covering "spotted locations", put this on his schedule.

BASIC MAPS

Supplementing this Patrol Schedule are a set of basic strip maps each representing a State and Numbered route in its entirety. These maps show the general shape of the route in its meanderings through the several towns, its crossing of town boundaries, its intersection with other State and Numbered routes and all other roads and highways.

On the border are given mileages from the start to the end of the route, and at town lines and intersecting routes, so that distances may be readily determined by simple additions and subtractions. By means of arrows the mile blocks found in the Road Patrol Schedule are determined for ready reference.

There also will be found railroad crossings, bridges, underpasses, rivers and other pronounced features to enable definite spots on the route to be located. By means of code numbers of four digits enclosed in a box, thus - 1768 - with leaders

running to the route itself, there has been identified over twelve hundred locations on these routes. Each of these locations has had its physical features placed on a "Coded Site Map" bearing the same number as that in the box (these maps will be available under separate covers) for use in the preparation of accident reports or in considering troublesome spots in the miles patrolled.

For each of these coded sites there is available one or more violation record covering the habits of drivers taken at these points within a period of two and a quarter years. On request a complete record for any such site can be obtained for use with the patrol schedule.

If information spotted as a point in any given mile in the schedule calling for special enforcement work happened to apply to one of these coded sites (as explained in "Spotted Locations" above) the code number will be given and the location quickly found on the map, thus insuring its correct identity.

Work sheets of each Troop Area showing towns and routes in the towns, are available. One form gives the routes with numbers, the other gives the routes with mile blocks identical with those in the Patrol Schedule. These will be found helpful in planning the patrolled areas and assigning patrolmen.

CONCLUSION

In any well executed piece of work good equipment is essential. So, also, is a proper use of such equipment. Just as the Bertillion System of finger prints is a logical piece of police equipment so also, is data of the sort herein described for the planning of a highway patrol system. It is intended to be just that, and over a period, to be perfected by cooperation with the officers who plan patrol, into the finest thing of its kind in the hands of any State Police force.

The record of the Massachusetts State Police in reducing accidents during the last three years has been unqualifiedly good. It is hoped that this addition to its equipment will make its work in this field the envy of all other State Police groups in this country. If intelligently used, and perfected by intelligent use over a long enough period, it will do just this.

(k) Field Studies - Based on carefully planned scanning of the accident records, and of the previous field studies (the term field studies is used interchangeably with behavior studies to indicate all records of the wrong driving habits or violations of motor vehicle operators wherever taken) those locations found to be hazardous and requiring immediate study, are determined.

It has been found that the predominating causes for the accidents reported, and of the prevailing and most pronounced type of violation, at any given site, usually are similar. The field study is made to determine whether the predominating violation has increased in frequency or a new type of violation has spring up. This indicates at once whether the patrol effort should be increased in this direction or whether study should be made to determine that the predisposing cause is due to some construction or equipment feature of the location calling for engineering treatment.

Based on these records of known conditions at a site a Recommended Study Sheet is made out and sent to the field supervisor concerned, indicating what studies, based on all previous accident and violation records, seem necessary and the time when such studies apparently should be made. A copy of this sheet serves as an office record until work is completed and the additional information added to the accumulated facts concerning the site.

If the supervisor believes the study useless, or in need of change, based on his intimate knowledge of the location and the conditions there existing, he returns it with such changes for correction; otherwise, he returns it as a guide showing the office what records to expect later from the field. When received by the troop supervisor a Location Sheet is made by him (which becomes the job order for the actual field crew which will do the work) giving the exact instructions as to time, location, direction of traffic, location of observers, men and equipment required, and a brief line sketch to avoid errors of duplication of observations or direction. The field studies are then made in due course at the time thus set. Normally, some thirty thousand man-hours have been used in this work quarterly.

(k) Field Studies Cont'd - A copy of this location sheet is retained in the Boston Office Computing Division as an indication of what work was finally done, and when. This plan is simple and avoids needless studies. It enables accurate records to be taken when and where necessary.

(l) Field Study Forms - After considerable study, trial in use, and constant effort to reduce our field study sheets to the simplest form, a set of eight field forms was evolved which proved satisfactory. These forms consist of, and cover, the items below.

S - Stop Sign Obedience

Made full stop
No interference - interference

Failed to Stop
No interference - Under 3 m.p.h. and over 3 m.p.h.
Interference - Under 3 m.p.h. and over 3 m.p.h.
Note: - Interference means cross traffic on street protected by the stop sign.

TD - Driving & Traffic Signal Violations - Vehicular*

Entered facing red
Entered facing red and amber
Caught on red
Entered on flashing red
Started too early
Over-ran stop line
Turning from wrong lane
On left of center line
Passing at intersection
Excessive speed
Passing to right recklessly

Note: - Proper record of nature of signal equipment whether pre-timed, semi-automatic, full automatic, constant directional arrows, and timing. Pedestrian button control at location noted. Also hours when operated manually by police or set flashing. The driving violations on this form are the most prominent violations occurring at intersections controlled by Traffic Signals.

D - Driving Violations*

Turning from wrong lane-left and right
Failing to keep right-{Car coming opposite direction / Car behind tries to pass}
On left of center line at hazard
Excessive speed
Passing at hazard
Cut corner-left or right
Following too closely
Cutting in too close
Cutting out with car coming
Passing on right recklessly

P - Traffic Signal Obedience - Pedestrian*

Crossed on red and amber
Crossed with green
Crossed against red
Diagonal (jay-walking)

Note: - See note under TD above

H - Speed Record at Hazard

Time recorded by stop watch, required for vehicle to travel in speed trap between two points a known distance apart. By calculation (in the office) these times are reduced to miles per hour.

EHO - Speed Record (Electric Meter)

Time recorded by Electric Speed Meter required for vehicle to travel in speed trap between two points a known distance apart.

L - Lighting Violations

Headlights OK
Headlights out
  Left or right headlight shows
  Side lights only in use
  Front end totally dark

Tail lights
  Not red (illegal unless red shows)
  Dark except auxiliary (if one shows)
  Totally dark rear end

Green clearance lights (trucks only)
  OK
  None or out

L - Lighting Violations Cont'd

Note: These studies are taken simultaneously all over the State prior to and just following the semi-annual equipment inspection by the Registrar of Motor Vehicles. Found to be sufficient to show trend.

V - Volume Count

This record is required to be taken with studies previously listed unless marked with an asterisk thus (*), and supplies the basis for percentage and direction of recorded violations. Some studies constitute their own volume record and are marked (*) in (T) (P) (D) above.

In General - On all field study sheets record is made of the nature and condition of the road surface, of the weather and its changes during the study period, and of any artificial illumination existing at the site. Studies continue usually for a full, continuous six, or twelve hour period and, depending on the character and accident record of the site, may be studied as often as twice in each quarter to secure accurate data on trends or to determine the results of suggested changes or of intensive police patrol for traffic violations.

As described hereinbefore, certain members of the field crew check strip maps in the field and also take local police records when required.

(m) Mobile Crew - For Speed Studies on Open Highways

Three speed crews were maintained for the purpose of securing the maximum observation of volume and of accuracy of determination of the speed of vehicles in their normal, uninterrupted flow over the highways in order to give the sponsor and others interested in, or in need of, speed data facts of a reliable nature.

Locations of sites to be studied were selected by the supervisor at points where speed normally prevails. These records were used for correlation with other speed studies made by the regular field crews and to indicate the regions or special locations where excessive speed appears to exist beyond reasonable limits

(m) Mobile Crew - For Speed Studies - On Open Highways - Cont'd - either temporarily (e.g. during the movement to and from race tracks, games, etc.) or permanently. This enables the sponsor more adequately to control traffic movement and driver behavior on the basis of peak conditions, either of speed, volume or violation, and to maintain maximum traffic flow under abnormal conditions apart from behavior control.

This equipment consists of three electric speed-units designed and improved by this project, including the road trips. These trips are spaced either sixteen or three feet apart, depending on the recorder used at the time. The vehicles operate the recorders by passing over each trip in turn and thus starting and stopping the recording circuits.

The machines consist of two operating circuits, the first operated by the car passing over trips actuating the relays, thus opening and closing the secondary measuring circuit. The secondary circuit measures the current absorbed by a condenser during the time the vehicle being clocked passes between the trips. The milliampere-meter is calibrated to record the actual speed in miles-per-hour directly on its dial.

The entire device weighs about 50 pounds, is self-contained, can be set up in five minutes, requires only one observer and one recorder, records accurately to within less than 1% error above fifteen miles per hour and can record 98% of traffic up to 900 cars per hour in either one or both directions, and 100% below 700 cars per hour. It required no complicated road mechanism.

Development work on weather-proofing the road trips has made the device applicable to use in any weather. A supplementary electrical unit, termed a "trip eliminator", is being developed to handle any short-circuiting of trips due to dampness from weather up to a permanent, metal-to-metal, dead short circuit. These improvements prevent lost time due to failure of instruments.

A supplementary "Vixible Trip" or "Speedscope" has been completed for use, either with these machines for short observations (to avoid setting road trips) or for stop watch use, thus greatly simplifying all road speed

(m) Mobile Crew - For Speed Studies - On Open Highways - Cont'd studies of the field crews and offering a simple, inexpensive, portable, clocking-unit (total cost $1.50) for use by police cruisers which removes the need for a road patrolman to keep in motion to check speeds. With this device he can station himself at a location and determine those he will arrest. A unit can be easily carried in the pocket.

These devices are unique and far superior to any type yet used anywhere else. They represent equipment eventually to be turned over to the sponsor for similar work it is not now equipped to do.

(n) Mobile Crew Speed Records - Each studied site is coded by number, and its exact location and number are shown on the map by an arrow on the route strip maps as a foundation.

Beside each such location a brief summary of speed observations is tabulated in a block giving details of date, time, direction and volume, with the average speed and the highest speeds recorded for both directions of traffic at that site. Supplementing these maps is a complete tabulation by half hours and by five-mile ranges, of all speed records taken at the site, to give more complete information. There is also a tabulation, by routes, of all cars observed passing any site at speeds in excess of fifty miles-per-hour, shown by five-mile ranges. These last records are "high spot" records for use of the sponsor's patrolmen.

Such records enable the sponsor to know, by percentage of total volume, and time periods, locations where patrolling for excessive speeds should prevail, even if accident severity has not been recorded. It constitutes prevention before, rather than correction after, death or injury.

(o) Hazardous Location Studies - Many locations with continued accident proneness call for repeated study to determine the several causes for constantly recurring accidents, whether these accidents are of the same general; repetitive, or of a differing nature. The troubles may be due to static conditions such as parked vehicles "bottle necks" slowing

(o) Hazardous Location Studies - Cont'd - heavy traffic or to other more subtle circumstances quite as hindering, such as a poorly timed traffic signal. The study of a location by field crews, followed by the repeated examination, at different times and under all various changes of traffic, by men skilled in traffic engineering, usually indicates the causes and reveals the remedies.

These studies are originated in several ways. The location may be found from examination of the accident and the behavior record; local or State Police know and report it to be bad; or field men automatically discover it; or it is reported as a result of public clamor.

Many, in fact most, of all towns and cities, except those large enough to maintain traffic officers of divisions, have no adequate force or personnel to study such locations. The Department of Public Works Highway Division acts only on written request so that such towns and cities are often unable to properly prepare data and plans and formulate requests for securing action for the cases arising with them.

More than one hundred such hazardous locations have been studied and reported on. Studies are in preparation, or are under way or on file, for urgent attention for as many more. They constitute a logical additional use of the facts ascertained by this project for the sponsor and are of value to others as a by-product produced at no appreciable increase in the cost to the project. Much of this data applies to locations falling in the patrolled area covered by the sponsor and aids in its proper action at such localities.

These reports may involve only a single page of facts and recommendations, or run to sizable reports of a hundred or more pages. Most reports are supplemented with diagrams, charts, photographs and other features. Letters on file from all parts of the State attest the desire for such studies, and the need for, and value of such work.

(p) Town Reports - As a logical sequence to the hazardous location reports, we were asked at various times to make reports for various towns and cities. This appeared so logical that we were authorized by W.P.A. officials in Washington to start January 1937 making reports for not over fifty towns and cities in Massachusetts. These reports were to be made only at the written request of town or city officials.

During 1937, forty such town reports were made, ranging all the way from a report on a single location in a town studied to determine one factor, to a complete traffic study of a town or city including volume of traffic, accident records, violations, light control, channelizing intersections, etc.

This work was done by competent engineers, and we feel has been an outstanding part of the work of this project.

Letters received from town or city officials for whom we have done this type of work have been very commendatory.

(q) Miscellaneous Factual Data - During the normal course of working up the data gathered under the preceding activities, it is obvious that many special groupings and arrangements of data thus prepared would be found valuable to other people than the sponsor.

Whenever these facts were deemed useful they have been issued to municipal officials, safety groups, schools, etc. They often serve to answer letters or messages of inquiry constantly received by the sponsor, as well as by the project, without further preparation or research.

No accurate record exists of the actual total of individuals or groups to which dissemination of this matter has been made, but there are on record in the files copies of more than one hundred special reports on different subjects, with tabulations and comparisons, completed and issued. In addition there is, in the normal course of the work, constantly being built in more or less complete

(q) Miscellaneous Factual Data - Cont'd - form for eventual binding as complete units, and as a part of the growing mass of facts, many more such reports and comparisons.

(r) Lectures - The sponsor has continued to turn over to the project practically all requests for lectures to schools, granges and other civic bodies calling for talks on matters pertaining to highway safety. This was a natural and legitimate use of the matter in our hands because several of our personnel were well equipped by experience to do such work. Nearly all lectures were augmented by the showing of one or more safety films.

In 1937, fifty-two (52) such talks, adapted to the age of the group, have been given to as many different audiences. Through these more than 14,000 persons have been reached.

Requests continue to come in constantly for this work and letters received indicate it to be valuable.

(s) Files and Records - The essential portion of all work as completed is put into permanent binders, indexed, cross-indexed and filed for constant use and future reference.

Summary Sheets made from the various Field Studies are kept readily accessible for constant reference and bound in volumes under town names. The original field sheets, on which the summaries were based, are wrapped in bundles and labelled for use if called for.

All reports, charts, etc. are bound, either in manuscript covers, manuscript backs, or cloth binders, depending on the frequency of their use and their importance. To avoid the loss, or mis-filing later by persons unfamiliar with the material, no loose folders are used for permanent records.

A book-binder is constantly occupied in map mounting, binding of the Quarterly accident reports and other records into permanent form in cloth and board covers.

(s) Files and Records - Cont'd - A card catalogue of all material has been kept complete for all material as added to the files. Every effort is being made to treat the records as of permanent value and to have them available for constant use and reference by proper cross-indexing. The attitude that records worth taking are worth proper keeping has been adhered to rigidly.

One prime purpose of the project was to create and maintain adequate data, constantly available for comparative reference, to show either improvement or retrogression in the accident condition in Massachusetts either for the State as a whole or for particular locations in the State. Because of the lack of such data many accident surveys fail to draw proper, accurate or helpful conclusions and the value of such work is often utterly lost.

The filing division operates a mimeograph, with which all forms for office and field use are printed and for such other work as is best reproduced in this form. Something over a million pieces have been thus issued at the minimum cost for paper, stock and ink.

A hectograph has been used for certain records desired in small numbers but from many copies, again to cut costs of stencil, typing and paper. Well over two hundred thousand sheets have thus been prepared for permanont records and copies thereof.

The sponsor, by request from this project has provided an Ozalid reproducing machine for all work formerly done by blue print or Van Dyke process. This saves time and cost, reducing the square foot expense from an average of six cents to a fraction over one cont. Better and faster work can be done. Prints can be made in five minutes, as needed, as against two to five days as heretofore involved in delivery from outside sources.

(t) Routine Office Methods and Equipment - In the course of handling the work of the project, there have been developed many useful tables, for reducing the work involved in computation, together with index lists, tabulations, forms, pin maps and short-cuts not needing description, but all designed to reduce waste motion and insure speed and accuracy.

(t) Routine Office Methods and Equipment - Cont'd

Adding and computing machines are used wherever possible and the consumption of all supplies is constantly watched. Mailing envelopes to and from the field, for example are used and re-used until worthless, often making five or six round trips. The entire work has been treated, so far as good management and red tape would permit, as a going business. Job orders, follow up, comparison of methods and changes in forms used are put into effect, or forms and practices abandoned, as soon as found necessary. It is assumed no detailed explanation of this work is required. It will, however, be available for use eventually by the sponsor or as a guide to any group undertaking a similar work.

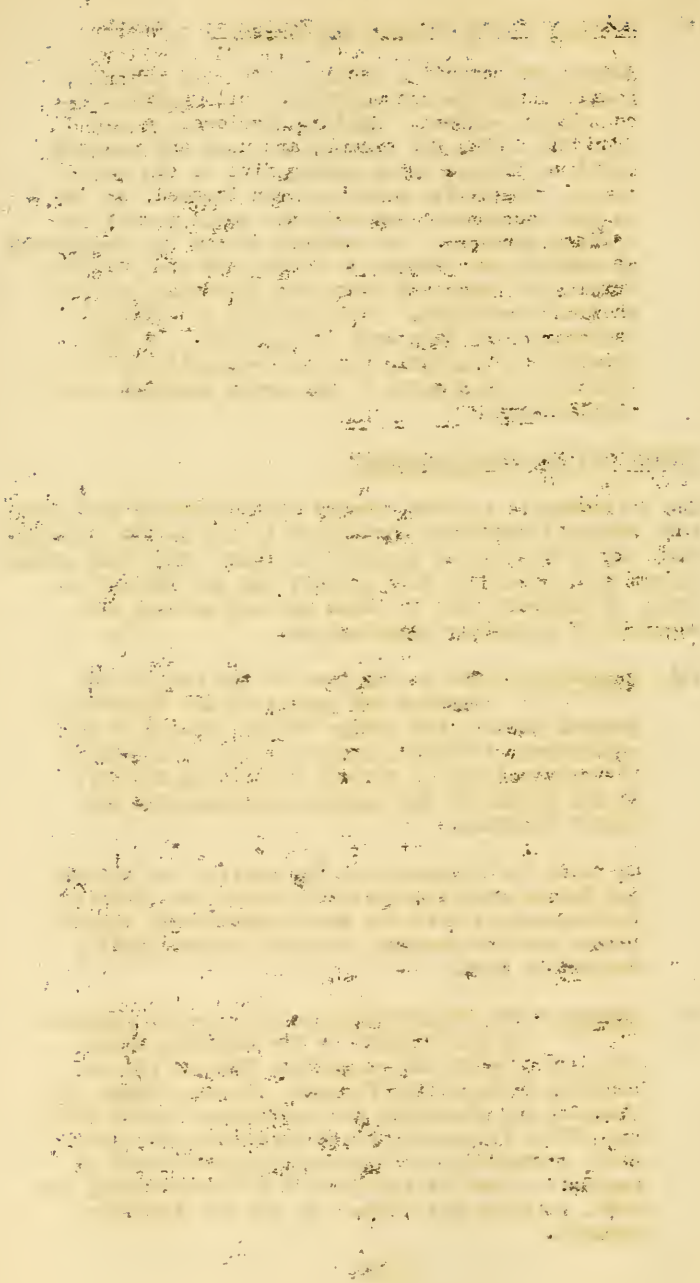
5. OPERATIONS AND ADMINISTRATION

The following is a brief summary of the various divisions into which it was found convenient to set up the organization and of the duties assigned to them. They were found suited to the work of this project and are offered as being of interest only to those who may attempt the creation of a similar organization.

(a) Supervisor - The acting head of the Project who handles and passes on all matters of general policy, has charge of the details of all employment, transfer, promotion and reassignment of employees and of records pertaining thereto. He has charge of and approves all payrolls and travel vouchers.

He forms the contact with the public, the sponsor and W.P.A. administrative officials and, jointly in conferences with the other subordinate supervisors and the manager, approves general policy devised by them.

(b) Manager - The Manager assigns all persons employed on the Project to the division where they are to work and re-assigns them to fit the changing needs of the Project. He has charge of planning and directing all operations in the field and office (excepting those pertaining to employment, accounting and time-keeping determined by regulation) and is responsible for determining new work, policies and plans. He has one Assistant Manager.



(c) Accounting - Time-Keeping - Purchasing - The work of preparation of Travel Vouchers is done under W.P.A. accounting regulations as, also, is the time-keeping. The purchasing agent handles all purchasing and related records. He is also custodian of all equipment loaned to the Project.

(d) Analysis Division - Has charge of the recording, re-checking, entering, segregating and analysis of all State and local police reported accidents for various uses and of correlating these with behavior summary records.

Treats behavior summaries in the same fashion, dividing into such segregation as will show statewide, troop-area, district, route and town trends or prepare them for such other reports as, from time to time, may be specified.

This division handled practically 18,000 such individual accident records and 15,000 field study summaries from June, 1936 to December, 1937.

From the foregoing material, prepares work sheets, about two weeks in advance, indicating locations for field crew to study, thus allowing proper assignment of crews by field supervisors.

Rates one-mile stretches for accident severity and prepares Route-Patrol map records based on such ratings.

Prepares work sheet from which the drafting division locates accidents on Accident Spot Maps prepared from the basic strip map.

Prepares special listings, analyses and reports for meeting the needs of the sponsor. These are used in reply to requests for facts pertaining to definite locations or areas.

This division derives and prepares all deductions and conclusions. From the compiled records it prepares various special reports covering facts based upon accident behavior records. Speakers and special programs are provided through it.

(e) Computing Division - The entire mass of field reports covering the behavior and violations of drivers is sorted, recorded and corrected, computed, checked and summarized in this division. Here the results of observations of the habits of nearly 9,000,000 drivers have been recorded and summarized through more than 15,000 individual studies at 788 different locations from June, 1936 through December, 1937.

The summaries present, in condensed form, the results of the several Field Studies described earlier. They are turned over to the Analysis Division for correlation with the accident records and form an important means for determining where, and to what extent behavior in driving is showing improvement or otherwise.

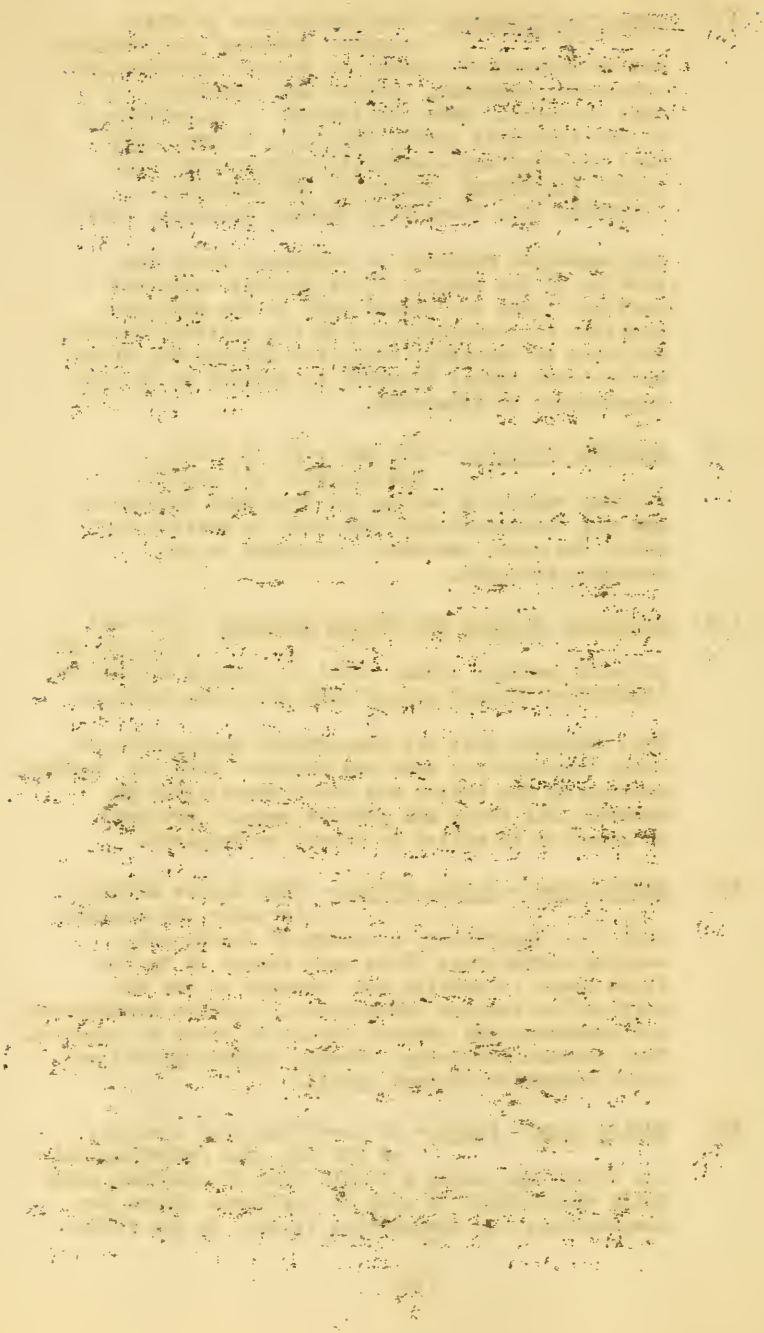
(f) Drafting Division - All map work of every description, all stencil cutting requiring ruling and free hand lettering, and all incidental drafting work is carried on under the usual procedure customary in any drafting division.

(g) Printing, Binding and Filing Division - Here all records are properly marked, coded, bound for proper filing and identified through proper card and cross indices.

This division does all mimeograph, hectograph and other reproduction work and prepares this for binding, mailing or for office and field requisition as needed. All forms and printed samples are kept in stock to be mailed or issued as required.

(h) Mobile Crew - Boston Office - This entire division is under the management of a Supervisor in charge of inside and outside operations. This work turned in by the field force is handled and computed by men who perform the regular calculations, special tabulations, and summaries and prepare copies of these as required. They prepare strip-maps showing Highway Speeds and block summaries of such speeds.

(i) Mobile Crew - Field - An observing crew consists of two men, one recording and one observing, using a simple form of original entry tally sheet which is sent to the Boson office for computation. No computation is done in the field.



(i) Mobile Crew - Field - Cont'd - One Mechanical Engineer is employed in the shops of Massachusetts Institute of Technology (where we have, by special arrangement, the free use of the shop and tools) in keeping road equipment in repair and in the development of improvements in trips and equipment. This type of work was discontinued in December, 1936, as it was felt that we had all information required from this type of work.

(j) Field Crews - For Motor Traffic Violation Observation

Each troop area is managed by a Supervisor, who is aided by an office clerk and an assistant, where the size of the unit requires.

An ordinary working crew consists of four checkers and one foreman with a car. The amount of work assigned determines the needs of each troop area and the number of crews required.

Each Troop Area Supervisor has his field office in one of the State Police headquarters for that area. Field offices are located in North Andover, Holden, Northampton and West Bridgewater, where they are provided with the office furniture and have the use of the teletype system to connect these offices with the Boston office. This service, the space and equipment, is furnished by the sponsor.

Each of the several field crews is set up as a complete unit with transportation, and has its official station in that portion of the troop area where the bulk of the work assigned to it normally lays. This is done to keep travel mileage at a minimum.

The Clerk acts as a clearing house at the Troop Area office and aids in assignment of work to crews, as indicated by the Supervisor, through location sheets and as originally called for by the field study forms from the Boston office, all as previously described in this report.

All field work was discontinued on September 30, 1937.

SECTION TWO

ON THE REPORT OF

THE HIGHWAY TRAFFIC RESEARCH

COVERING ITS

DEDUCTIONS - CONCLUSIONS - RECOMMENDATIONS

To December 1937

I FUNDAMENTALS CONTROLLING SECTION TWO

1 GENERAL BASIC CONSIDERATIONS

The ultimate aim of this project is to provide factual data which will assist the State Police in its traffic law enforcement activities. In compliance with this aim, the figures presented in this report are based on the accident and violation records studied and analyzed during the period from June 1, 1936 to December 30, 1937.

It is the function of the Analysis Division to analyze the accident records of drivers on the numbered routes of Massachusetts as taken from reports filed with the State Police, with the Local Police and M.D.C. Police, as well as the records of violations of drivers observed by our Field Crews.

After thirty-nine months of traffic survey and research a brief summary of what has been learned concerning accidents, their causes and the methods best suited to their reduction, should be of vital importance in the guidance of any group organized for the prevention of automobile accidents.

Attempting to outline the problem presented to the project and concisely and practically indicate the methods adopted and results attained, the following pages present the best efforts of our organization and are submitted with a real desire to provide factual data which will be of practical assistance to the State Police in its traffic law enforcement activities.

2 PROBLEM STATED

The elements of this problem eventually embraced the following considerations:

(a) To procure a complete list of the accidents reported as happening on State Highways and numbered routes in Massachusetts.

(b) To analyze these accidents for the information contained in them by a breakdown into causes, periods of time, road conditions, etc.

(c) To list the hazardous locations on these routes, based on accident records.

(d) To organize Field Crews to take observations of driver behavior and violations at these locations.

(e) To prepare proper forms to be supplied to the Field Crews for the recording of these violation observations.

(f) To organize an office force to tabulate, summarize and analyze these reports of accidents and of violations.

3 ACCIDENT RECORDS

During the time covered by this report, records of 21,000 accidents were taken from State, Local and M.D.C. police records, plus the 26,371 previously taken, and each one broken down into the factual items involved, so far as these were recorded or could be ascertained, thus indicating clearly much not heretofore known regarding such accidents.

Records were first compiled semi-annually from January through June inclusive. Beginning January, 1936, they are being taken, analyzed, tabulated and bound each quarter in order that the value of the information thus available will be put to use more promptly.

4 SEASONAL CONDITIONS

The work has continued without interruption throughout the entire period, in all four seasons, during both the day and night and in fair weather and foul. For these reasons the conclusions hereinafter expressed, where based on our records, are believed to be reasonable and supportable against any charge of error from these sources.

5 TROOP AREAS

The State of Massachusetts, for patrol purposes, is divided by the State Police into four areas, known as Troop Areas A-B-C-D respectively. The lines of demarcation in all cases follow town boundary lines.

Area A - Embraces northeastern Massachusetts, its western boundary running from the New Hampshire State line to the Rhode Island State line, from Dunstable south to Blackstone. Its southern boundary extends roughly southwest from Weymouth to Attleboro. In January, 1937, Braintree and Weymouth were transferred to Troop D.

Area B - Embraces the width of the State of Massachusetts, bound on the west by the New York State line and on the east by a line running roughly south from Northfield to Holland.

Area C - Embraces central Massachusetts, runs the width of the State, adjoining Troop B territory on the west and Area A territory on the east.

Area D - Embraces southeastern Massachusetts and Cape Cod. Its northern boundary is the southern boundary of Area A. In January 1937, Attleboro was transferred to Troop A.

Area A embraces several large cities and is, on the whole, distinctly urban. The other three troop areas, eliminating Worcester in Area C and Springfield in Area B, may be classed as rural territory.

6 AREAS OMITTED

Because of the congested and traffic-regulated areas represented by the cities of Boston, Worcester and Springfield, and the relatively small mileage of State Highways in these cities as compared with the entire State total of 3,309 miles, neither accident records nor driver behavior in these cities was included in the State total records. This avoids a proportionately large overloading and distortion of the entire State record by the introduction of accident and behavior records of a purely urban nature.

7 MOTOR TRAFFIC VIOLATIONS

For the period from June 1, 1936 to September, 1937 our field crews have recorded the motor traffic violations of 8,970,702 drivers operating cars in all parts of the State. This number, added to the 12,000,000 previously recorded, is sufficient, and taken during a long enough period to offer an average in which the personal errors of observation have, undoubtedly and to a great extent, averaged themselves out. Violation comparisons have been made for the four seasons of the year.

Any conclusions drawn, or recommendations made, if based on either the accident records and the motor traffic violation studies, are free from the error and bias due to single, isolated studies, to special times or to other limiting items.

8 CORRELATION OF ACCIDENT AND VIOLATION RECORDS

All deductions and recommendations, presented as a means for reducing accidents, were first predicted on the accident records. This accident record then had to be correlated with the recorded violations. For every accident there must be a cause. This cause can be attributed to either physical conditions, improper regulations, or error on the part of a driver or a pedestrian.

These human errors are shown by specific violations such as speed, cutting in or out of line, jay-walking and so on. The general statement can be made that accidents occur sooner or later at whatever point traffic violations are frequent. Therefore, it stands to reason that, if violations can be kept down, accidents will lessen.

Our work was to find out where the accidents occurred, what causes the accidents, what the violation record was at that point, and correlate these facts. The results of this correlation are so accurate that, knowing the outstanding violations and the amount of traffic at any given point, we can predict what type of accident and how many of them will probably occur at this point.

9 POLICE REPORTED HAZARDOUS LOCATIONS

Our contact with the State Police constantly supplies us with information as to what they feel are hazardous locations. The locations so reported are checked with our previous records, if any exist, with reference to accident frequency and previous behavior to determine if such locations call for study. Such an approach represents a means for the prevention of accidents rather than their correction after they have occurred.

As the value of our work is becoming known we are constantly receiving requests from local authorities for information.

10 TOWN REPORTS

At the written request of authorized town or city officials, we made for towns or cities during 1937, special reports relative to traffic conditions existing at specific hazardous locations. In some cases this meant just one location, in other cases it meant studying every major intersection on all numbered routes traversing the town or city, together with certain other streets (not numbered routes) that were "feeders" to these numbered routes and from which the flow of traffic affected conditions on the numbered routes.

These studies involved anything from a simple traffic volume count to a comprehensive study and analysis of types of violations by both drivers and pedestrians, the installation of traffic lights, proper timing of lights, channelizing of intersections, etc. Forty such reports were made and submitted to authorized enforcement officials in the respective towns and cities calling for same, and the reaction of these officials is evidenced by the letters received after the reports were submitted. The tenor of these letters indicates that this type of work was well done and greatly appreciated by the officials for whom it was done.

This type of work was done in the cities of Holyoke, Lynn, Malden, New Bedford, Newton and Salem. Small towns like Billerica, Chelmsford, Stoneham and Reading called for reports on a particular intersection or a highly congested area.

II DIVISIONS OF REPORT

The remainder of this Section Two of the whole report will first be carried through to the conclusions based on accident records and then to the conclusions based on driver behavior records. To this will be added a section discussing special studies of Hazardous Locations and Mobile Crew Studies of several routes, each section with its own conclusions.

The conclusions and recommendations based on each such main section, or any of its details will appear with the facts supporting them, thus affording better understanding of the point covered than if such a recommendation appeared by itself.

For convenience all recommendations will be later grouped, with references back to the text where it originated.

II DIVISIONS OF REPORT - Cont'd

In some instances figures derived from the Highway Traffic Research will be compared with figures for other areas, or the United States as a whole. The source of figures will be stated where quoted. All tables showing figures for all of the highways of the State of Massachusetts are quoted from the Registry of Motor Vehicles, while all figures for the United States are quoted from the Traveler's Insurance Company or the National Safety Council as indicated where used.

III and IV ACCIDENT STATISTICS

ACCIDENT RECORD
KILLED & INJURED
COMPARISONS BY GENERAL AREAS
YEARS 1935-1936-1937

	NUMBERED ROUTES IN MASSACHUSETTS			ALL ROADS IN MASSACHUSETTS			ALL ROADS IN UNITED STATES		
YR.	TOTAL ACCS.	PERSONS KILLED	PERSONS INJURED	ACCS.	KILLED	INJURED	ACCS.	KILLED	INJURED
1935	11296	300	13173	40138	795	48421	826690	36100	895280
1936	11734	297	13553	39010	817	45462	864800	36800	967840
1937	13372	270	15273	42407	784	49854	880150	40300	1221090
1936 Gain or Loss	+3.9	-1.0	+2.9	-2.8	+2.8	-6.1	+4.6	+1.9	+8.1
1937 Gain or Loss	+14.0	-9.1	+12.7	+8.7	-4.0	+9.6	+1.8	+9.5	+26.2

COMMENTS ON TABLE 1

This table shows a comparison for three (3) years of all accidents, fatal and non-fatal, occurring on the three areas shown above. It will be seen that accidents, fatalities and injuries are increasing each year in the U.S.

Massachusetts in 1936 showed a decrease in the number of accidents and injuries, but an increase in fatalities. In 1937 Massachusetts showed a good decrease in fatalities, with the increase of injuries only about one-third of the national increase.

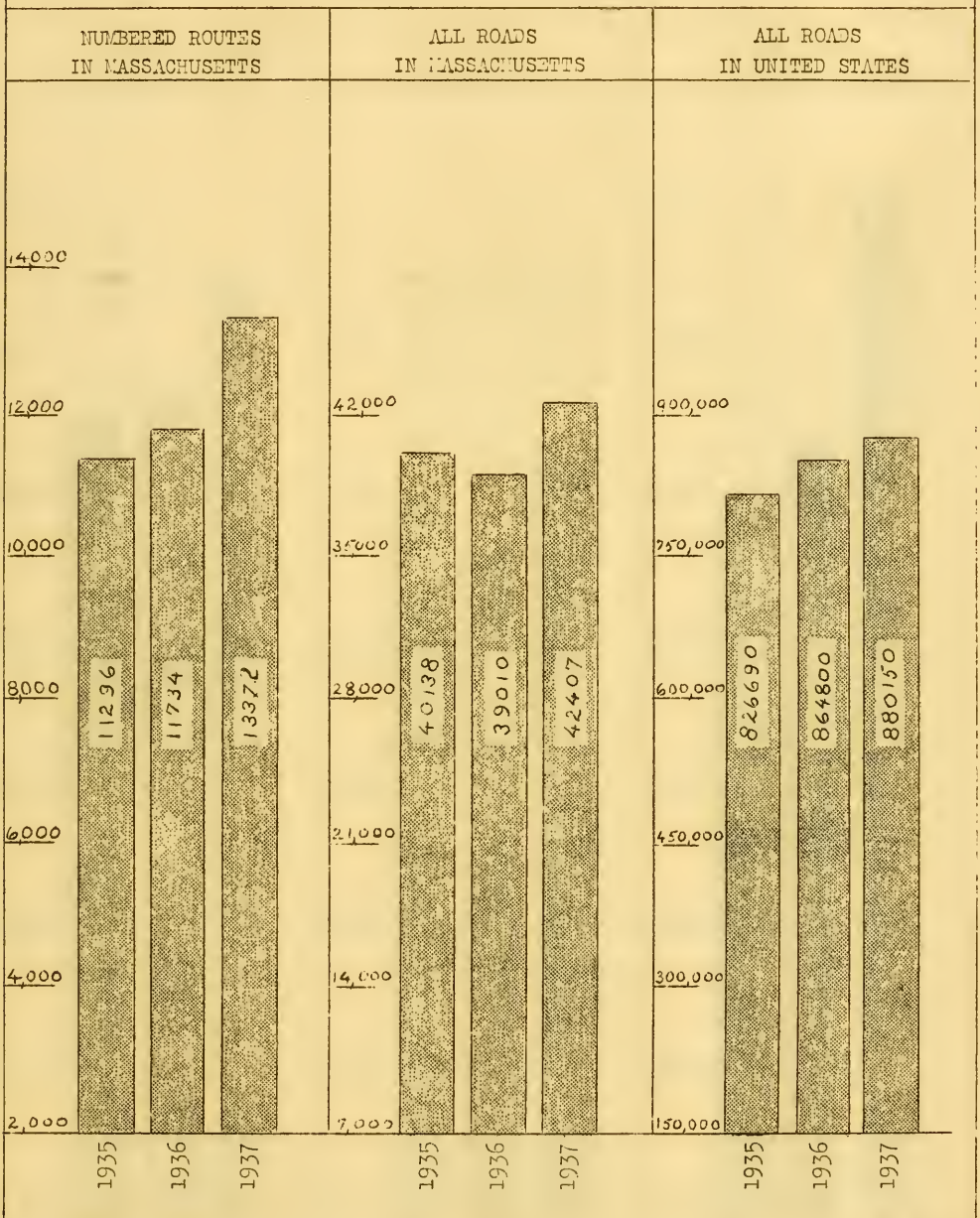
The numbered routes of Massachusetts in 1937 showed a decrease in fatalities of 9% compared with a decrease of 4% in the State of Massachusetts as a whole, and an increase of 9.5% in the U.S. The reason for this decrease in fatalities is unquestionably due to a drive to reduce speed in Massachusetts, augmented by selective enforcement by the State Police, for while there has been no decrease in the number of accidents, or the number of injuries, the fatality record has been less, which on the face of it would show that reduced speed has lessened the severity of accidents when they do occur.

The percentage of Massachusetts fatalities to the total fatalities in the U.S. is as follows:

2.2% in 1935
2.2% in 1936
1.9% in 1937.

CHART - 1A

ACCIDENTS
COMPARISONS OF GENERAL AREAS
YEARS 1935-1936-1937



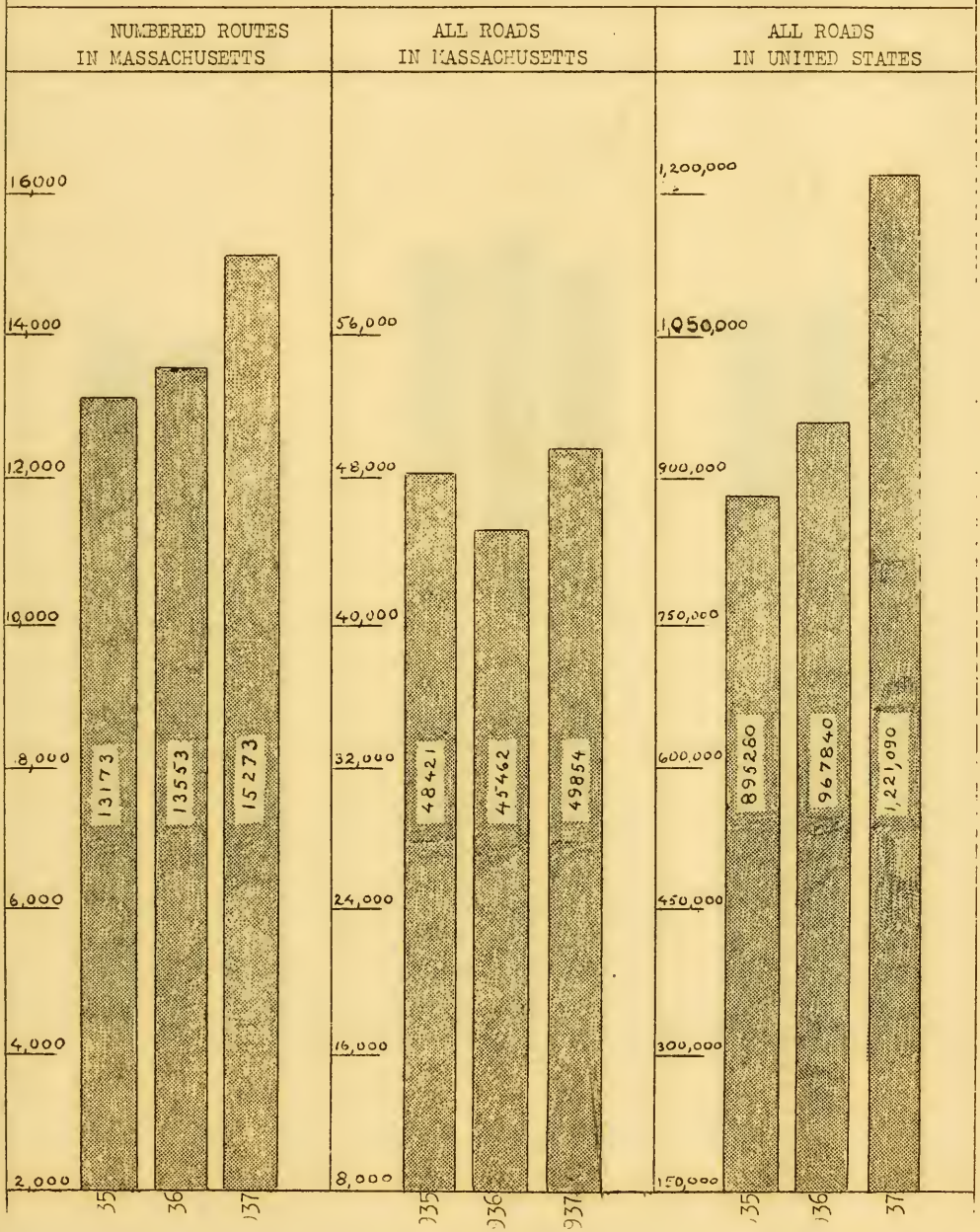
SCALE: 2000=1 Inch

SCALE: 7000=1 Inch

SCALE: 150,000=1 Inch

CHART-18

INJURIES
COMPARISONS OF GENERAL AREAS
YEARS 1935-1936-1937



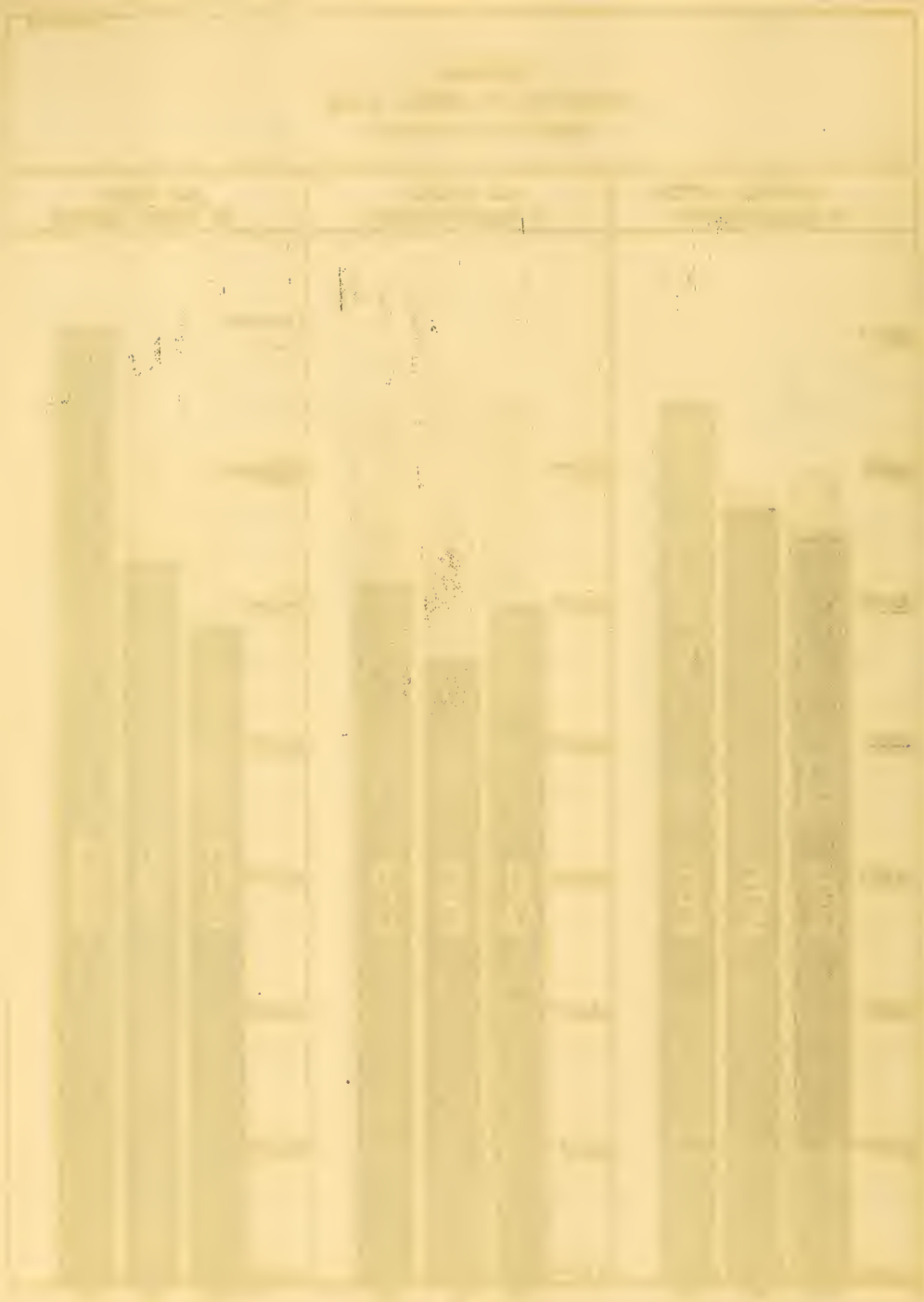
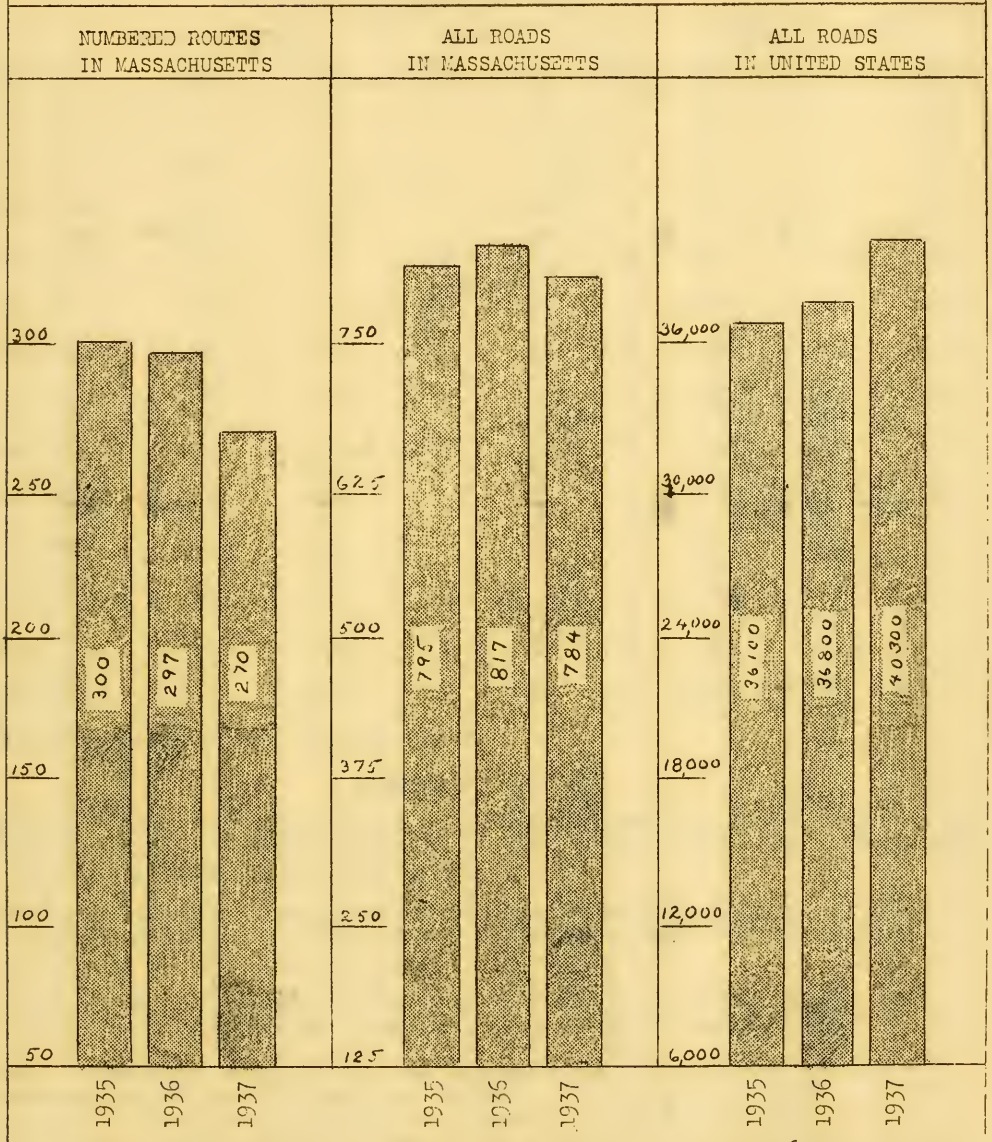


CHART-IC

FATALITIES
COMPARISONS OF GENERAL AREAS
YEARS 1935-1936-1937



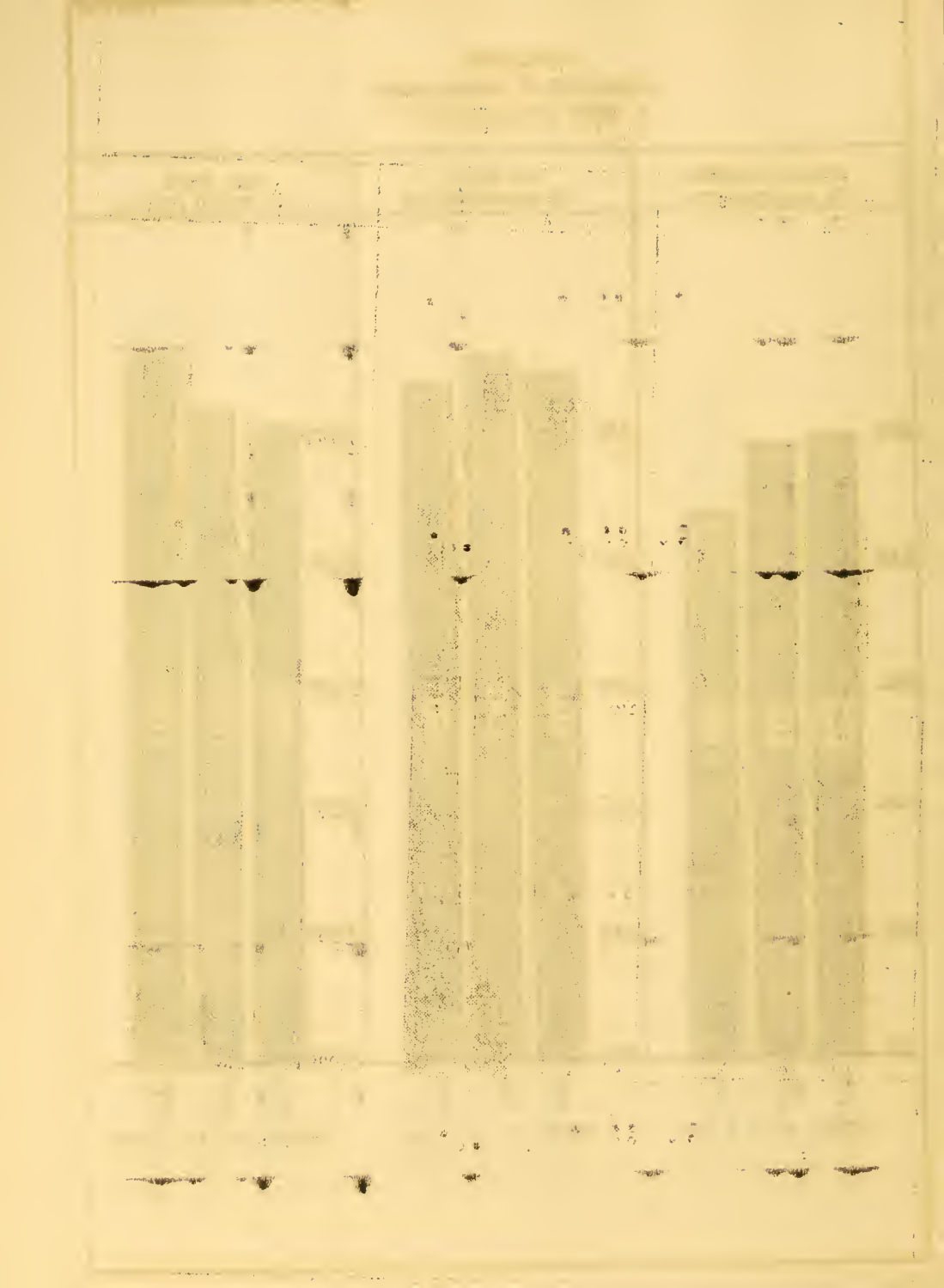


Table 2

MONTHLY RECORD OF ACCIDENTS-FATALITIES-INJURIES ON NUMBERED ROUTES OF MASS. YEARS 1935-1936-1937

MONTH	TOTAL ACCIDENTS 1935	1936	1937	PERSONS KILLED 1935	1936	1937	PERSONS INJURED 1935	1936	1937
Jan.	742	673	913	12	18	21	723	677	978
Feb.	839	681	739	10	12	17	948	687	728
Mar.	682	559	914	28	21	21	669	569	957
Apr.	804	760	985	24	14	20	880	829	1108
May	840	914	1103	21	22	20	943	1036	1304
June	1043	980	1172	31	11	29	1216	1261	1312
July	1137	1248	1209	20	30	10	1373	1501	1582
Aug.	1165	1322	1399	34	38	19	1570	1694	1765
Sept.	1028	1039	1098	29	36	23	1237	1337	1261
Oct.	1007	1114	1355	26	27	34	1217	1252	1552
Nov.	1076	1212	1177	34	32	26	1293	1337	1311
Dec.	933	1231	1308	31	36	30	1104	1372	1412
Total	11296	*11733	13372	300	297	270	13173	*13552	15273

*Month not stated on one accident reported.

Comments on Table 2

This table shows the largest number of accidents occurred in August of each year, while the smallest number of accidents occurred in March of the year 1935 and 1936, with February being the low month in 1937.

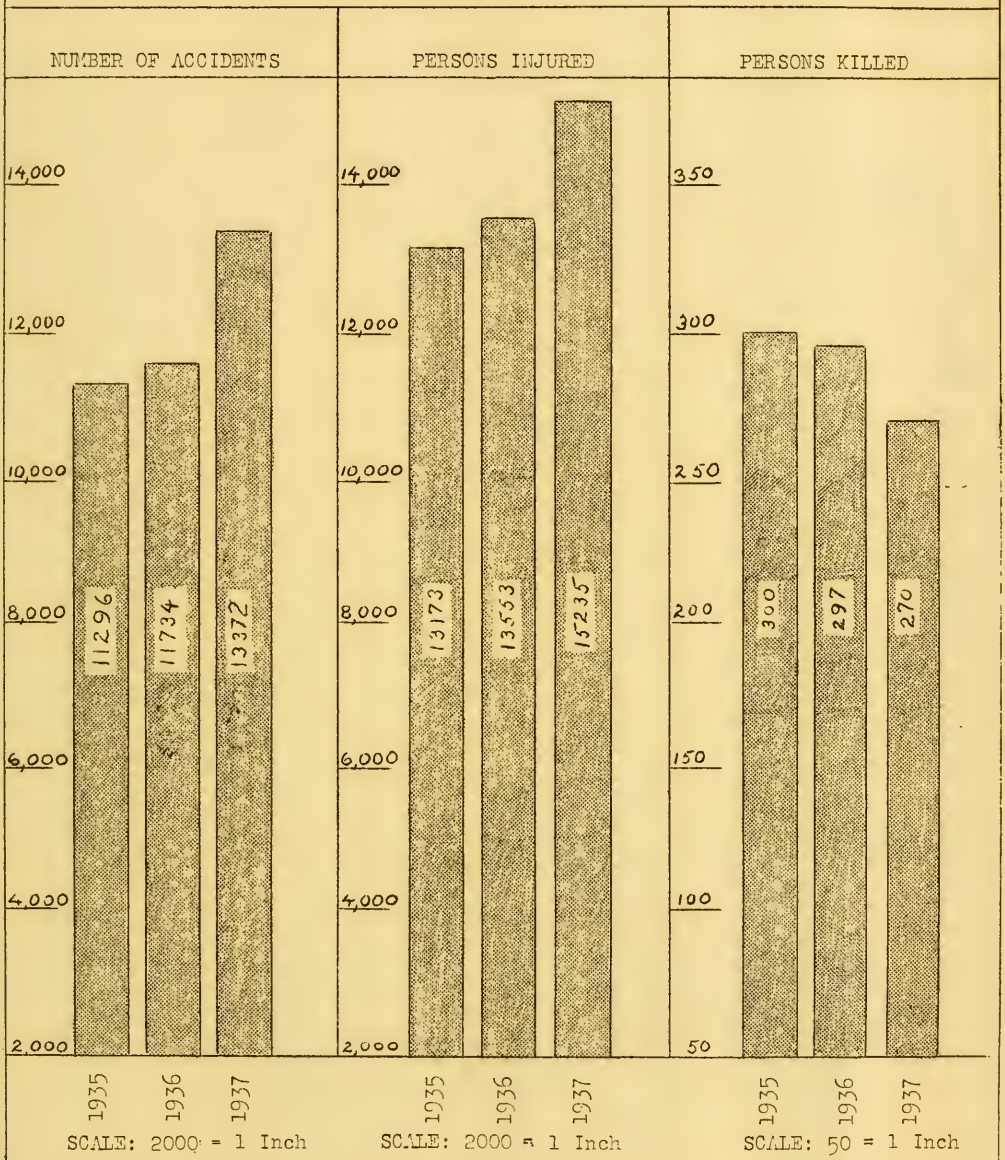
Fatalities were highest in August and November during 1935, August was high month in 1936, with October the high month in 1937. The month of lowest fatalities was February for all three years.

Injuries were most numerous in the month of August for all three years. March was the low month in 1935 and 1936, with February the low month in 1937.

These figures show conclusively that August is the worst month of the year for accidents on the State Highways and numbered routes of Massachusetts. All three years show the number of accidents and number of injuries reach their peak in August, with August responsible two out of three years for the highest number of fatalities. The reason for all this is, undoubtedly, due to the fact that the peak of traffic on these routes is during the vacation season, which reaches its apex in August. It is, however, worthy of note that in 1937 the vacation season of July, August, and September produced 52 deaths, while January, February and March, with the lowest amount of cars on the road, produced 59 deaths.

The gratifying part of this table is the fact that it shows a steady decrease in fatalities.

3 YEAR ANNUAL COMPARISON OF ACCIDENTS INJURIES & FATALITIES ON NUMBERED ROUTES IN MASS.



MONTHLY RECORD OF ACCIDENTS

ON MASS. STATE & NUMBERED ROUTES

REPORTED BY STATE - LOCAL - M.D.C. POLICE

YEARS 1935-1936-1937

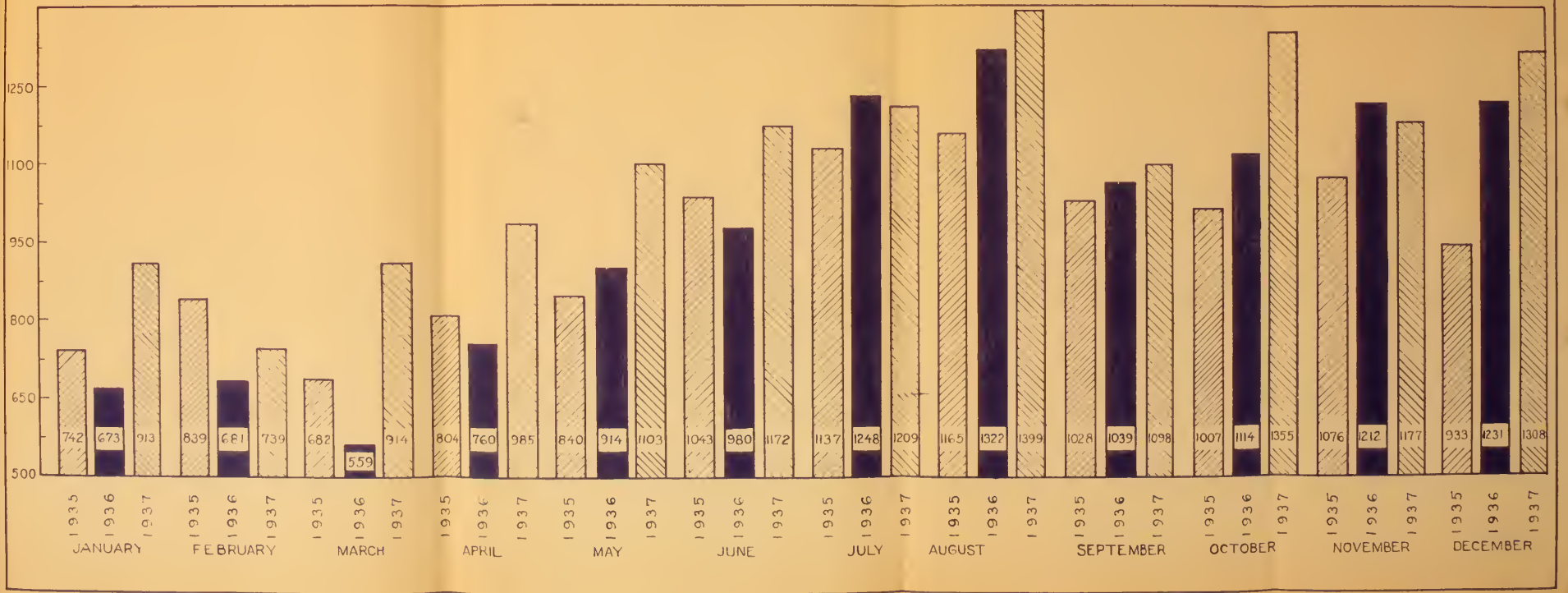


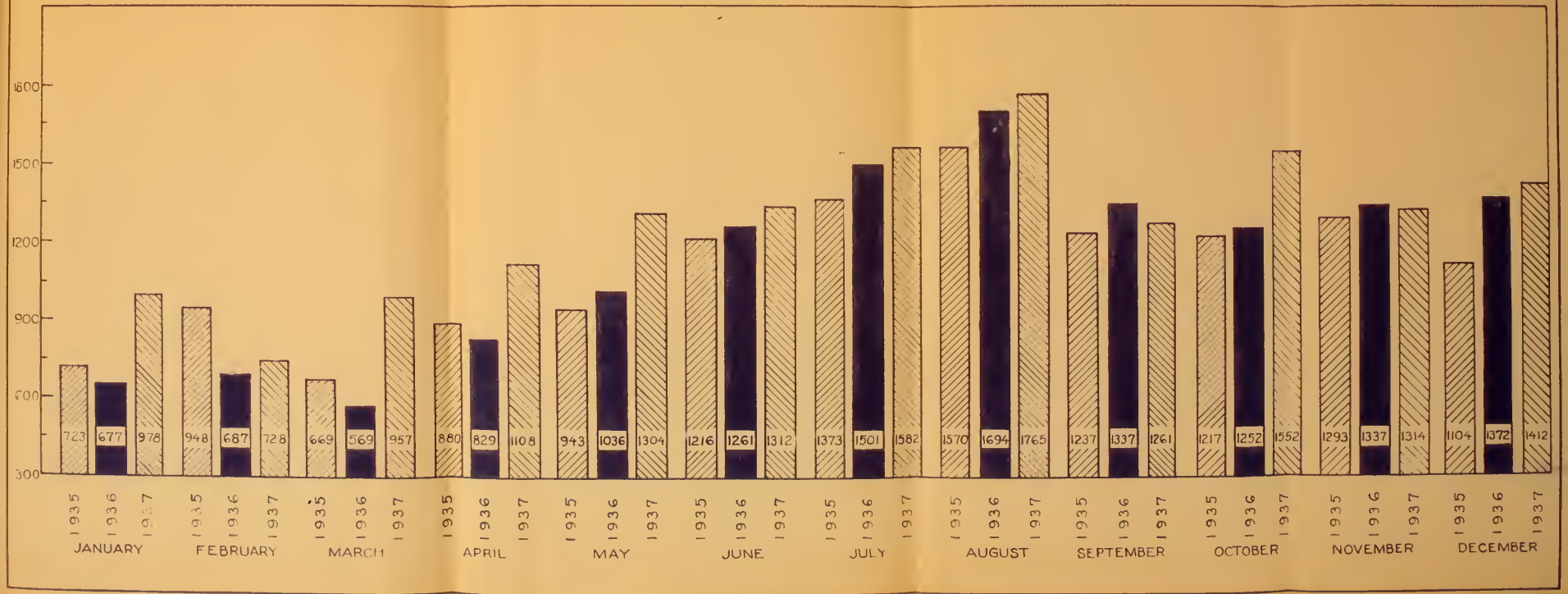
CHART OF

MONTHLY RECORD OF PERSONS INJURED

ON MASS. STATE & NUMBERED ROUTES

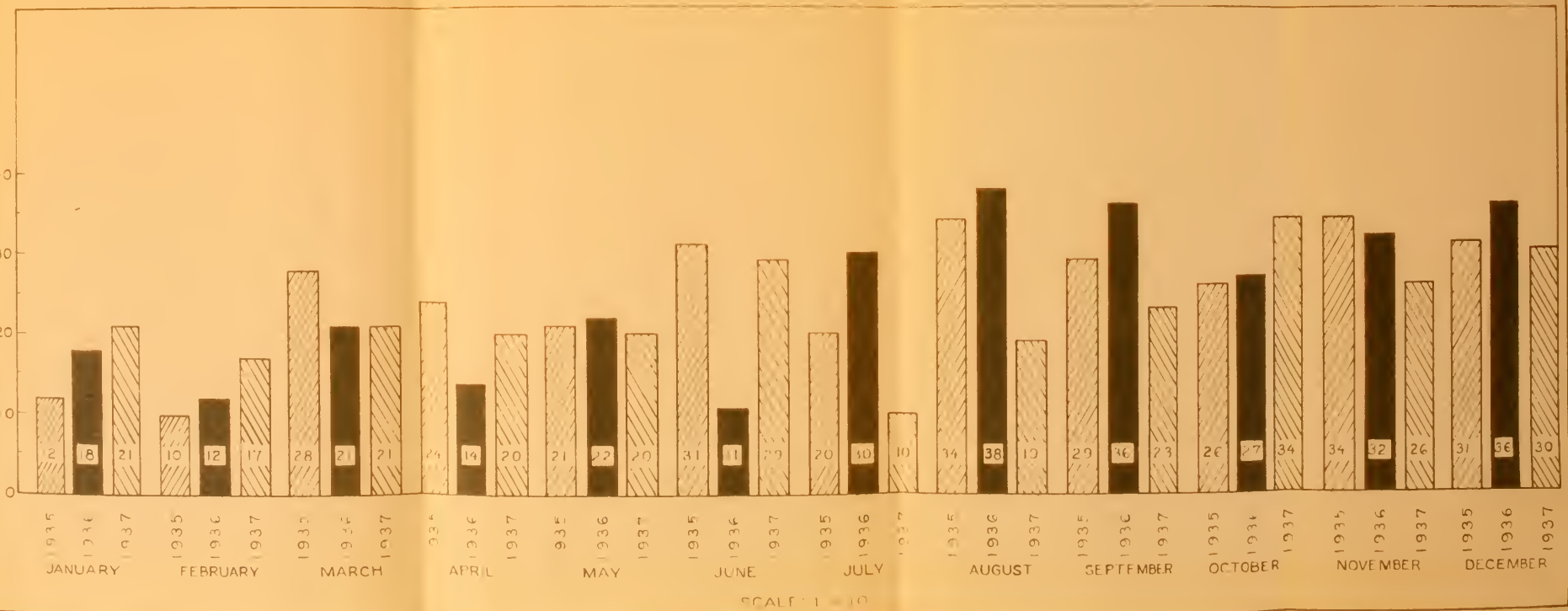
REPORTED BY STATE LOCAL-M.D.C POLICE

YEARS 1935 1936-1937



MONTHLY RECORD OF FATALITIES

ON MASS STATE & NUMBERED ROUTES



ACCIDENTS BY MONTHS
A COMPARISON OF
YEARS 1935-1936-1937
FOR
MASSACHUSETTS NUMBERED ROUTES

	1935		1936		1937	
MONTH	TOTAL	%	TOTAL	%	TOTAL	%
January	742	6.6	673	5.7	913	6.8
February	839	7.4	681	5.7	739	5.5
March	682	6.1	559	4.8	914	6.8
April	804	7.1	760	6.7	985	7.4
May	840	7.5	914	7.8	1103	8.3
June	1043	9.2	980	8.3	1172	8.8
July	1137	10.0	1248	10.6	1209	9.0
August	1165	10.3	1322	11.3	1399	10.5
September	1028	9.1	1039	8.8	1098	8.2
October	1007	8.9	1114	9.5	1355	10.1
November	1076	9.5	1212	10.3	1177	8.8
December	933	8.3	1231	10.5	1308	9.8
Totals	11296	100.	*11733	100.	13372	100.

*Month not stated on one accident reported.

COMMENTS ON TABLE 3

This table is made to show the percentage of number of accidents occurring each month, otherwise the information contained is the same as that set forth in Table 2, and all comments made on Table 2, covering number of accidents, applies to this table.

INJURIES BY MONTHS
A COMPARISON OF
YEARS 1935-1936-1937
FOR
MASSACHUSETTS NUMBERED ROUTES

	1935		1936		1937	
MONTH	TOTAL	%	TOTAL	%	TOTAL	%
January	723	5.5	677	5.0	978	6.4
February	948	7.2	687	5.1	728	4.8
March	669	5.1	569	4.2	957	6.3
April	880	6.7	829	6.1	1108	7.2
May	943	7.2	1036	7.6	1304	8.5
June	1216	9.2	1261	9.3	1312	8.6
July	1373	10.4	1501	11.0	1582	10.4
August	1570	11.9	1694	12.5	1765	11.5
September	1237	9.4	1337	9.9	1261	8.3
October	1217	9.2	1252	9.3	1552	10.2
November	1293	9.8	1337	9.9	1314	8.6
December	1104	8.4	1372	10.1	1412	9.2
Totals	13173	100.	13552	100.	15273	100.

COMMENTS ON TABLE 4

This table is made to show the percentage of number of injuries occurring each month, otherwise the information contained is the same as that set forth in Table 2, and all comments made on Table 2, covering number of injuries, applies to this table.

FATALITIES BY MONTHS
A COMPARISON OF
YEARS 1935-1936-1937
FOR
MASSACHUSETTS NUMBERED ROUTES

MONTH	1935 TOTAL	1935 %	1936 TOTAL	1936 %	1937 TOTAL	1937 %
January	12	4.0	18	6.1	21	7.8
February	10	3.3	12	4.0	17	6.3
March	28	9.4	21	7.1	21	7.8
April	24	8.0	14	4.7	20	7.4
May	21	7.0	22	7.4	20	7.4
June	31	10.4	11	3.7	29	10.8
July	20	6.7	30	10.1	10	3.7
August	34	11.3	38	12.8	19	7.0
September	29	9.6	36	12.1	23	8.5
October	26	8.6	27	9.1	34	12.6
November	34	11.3	32	10.8	26	9.6
December	31	10.4	36	12.1	30	11.1
Totals	300	100.	297	100.	270	100.

COMMENTS ON TABLE 5

This table shows the percentage of fatalities by months, otherwise it contains the same information set forth in Table 2, concerning fatalities. Comments made on Table 2 relative to fatalities apply to this table.

It is interesting to note that the months of June and July reversed themselves in 1937 from the previous year. In 1936, June showed 3.7% of the total fatalities and July showed 10.8%, while in 1937, June showed 10.1% and July 3.7%.

August, 1937, shows an improvement of 45.3% over the previous year. It is also worthy of note that October, which was the worst month in 1937, has been steadily growing worse over the three year period. This is also true of January and February.

SEASONAL VOLUME & PERCENTAGE OF ACCIDENTS TO YEARLY TOTALS (1935-6-7) ON NUMBERED ROUTES IN MASSACHUSETTS

Winter Qr. Jan. - Mar.	Spring Qr. Apr.- June	Summer Qr. July - Sept.	Fall Qr. Oct. - Dec.	Year Total
No. - %	No. - %	No. - %	No. - %	
2303 - 20.0	2728 - 23.8	3382 - 29.5	3058 - 26.7	1935 - 11,296
1913 - 16.4	2654 - 22.6	3609 - 30.7	3557 - 30.3	1936 - 11,734
2566 - 19.2	3260 - 24.4	3706 - 27.7	3840 - 28.7	1937 - 13,372

COMMENTS ON TABLE 6

This table shows conclusively two things: 1st, Climatic and road conditions have a distinct bearing on the accident record; 2nd, Volume of traffic alone does not account for the number of accidents.

This table bears out the first statement when it shows about 18% fewer violations in the Winter quarter of 1936 than in 1935 or 1937. During this period we had severe cold and the roads were blocked with snow. Fewer cars were on the road and the drivers of these cars were exercising more than ordinary caution. The Winter quarter of 1937 was open, mild weather with the roads for the most part free of snow and ice. Under these conditions accidents increased in number.

The second statement is borne out by the fact that with fewer cars on the road during the Fall quarter, due to withdrawal of tourists and vacationists, the accident record in 1936 is almost as large as the accident record for the Summer quarter with its maximum of traffic, while in 1937 the Fall quarter shows more accidents than the Summer quarter.

DAY OF WEEK
COMPARISON OF NUMBER OF ACCIDENTS
FOR
YEARS 1935-1936-1937
ON
NUMBERED ROUTES IN MASSACHUSETTS

Yr.	Mon.		Tues.		Wed.		Thurs.		Fri.		Sat.		Sun.		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1935	1422	12.6	1314	11.6	1384	12.3	1468	13.0	1512	13.4	2102	18.6	2090	18.5	*11292	100.
1936	1404	11.9	1376	11.7	1458	12.4	1485	12.7	1583	13.5	2198	18.8	2225	19.0	*11725	100.
1937	1701	12.7	1528	11.5	1457	10.9	1653	12.4	1925	14.4	2503	18.7	2596	19.4	*13363	100.

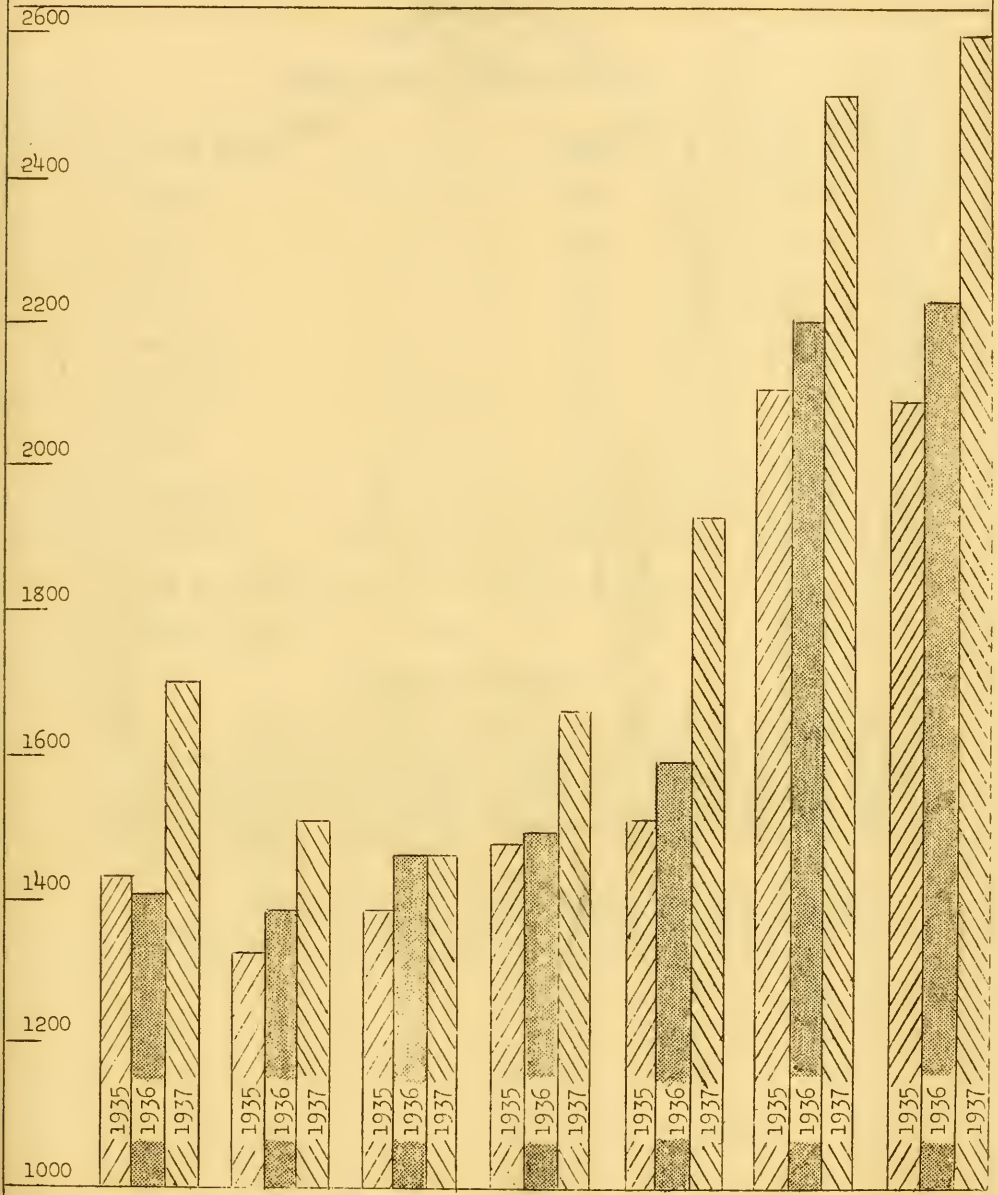
*Day of week not stated on four accidents.
* " " " " " " nine "
* " " " " " " nine "

COMMENTS ON TABLE 7

This table shows Saturday had the greatest number of accidents in 1935. In 1936 and 1937, Sunday was the worst day, but the percentage between Saturday and Sunday is very slight. When Saturday and Sunday are combined we see at a glance that the week-end is prolific of accidents, giving us 37.1% of the accidents in 1935; 37.9% in 1936; and 38.1% in 1937. It will, also, be seen that the record is getting worse year by year for this week-end period.

CHART-7A

ACCIDENTS BY DAY OF WEEK
COMPARISON OF YEARS 1935 1936 1937
ON MASS. NUMBERED ROUTES



SCALE 200 to 1"

INJURIES BY DAY OF WEEK
A COMPARISON OF
YEARS 1935-1936-1937
FOR
MASSACHUSETTS NUMBERED ROUTES

	1935		1936		1937	
DAY OF WEEK	TOTAL	%	TOTAL	%	TOTAL	%
Sunday	3048	23.1	2996	22.1	3598	23.5
Monday	1535	11.6	1604	11.9	1883	12.3
Tuesday	1398	10.6	1441	10.6	1551	10.2
Wednesday	1527	11.6	1626	12.0	1537	10.1
Thursday	1628	12.4	1589	11.7	1719	11.3
Friday	1587	12.1	1648	12.2	2147	14.1
Saturday	2450	18.6	2640	19.5	2827	18.5
Totals	13173	100.	*13544	100.	*15262	100.

*Day of week not stated on 9 accident reports.

*Day of week " " " 11 " "

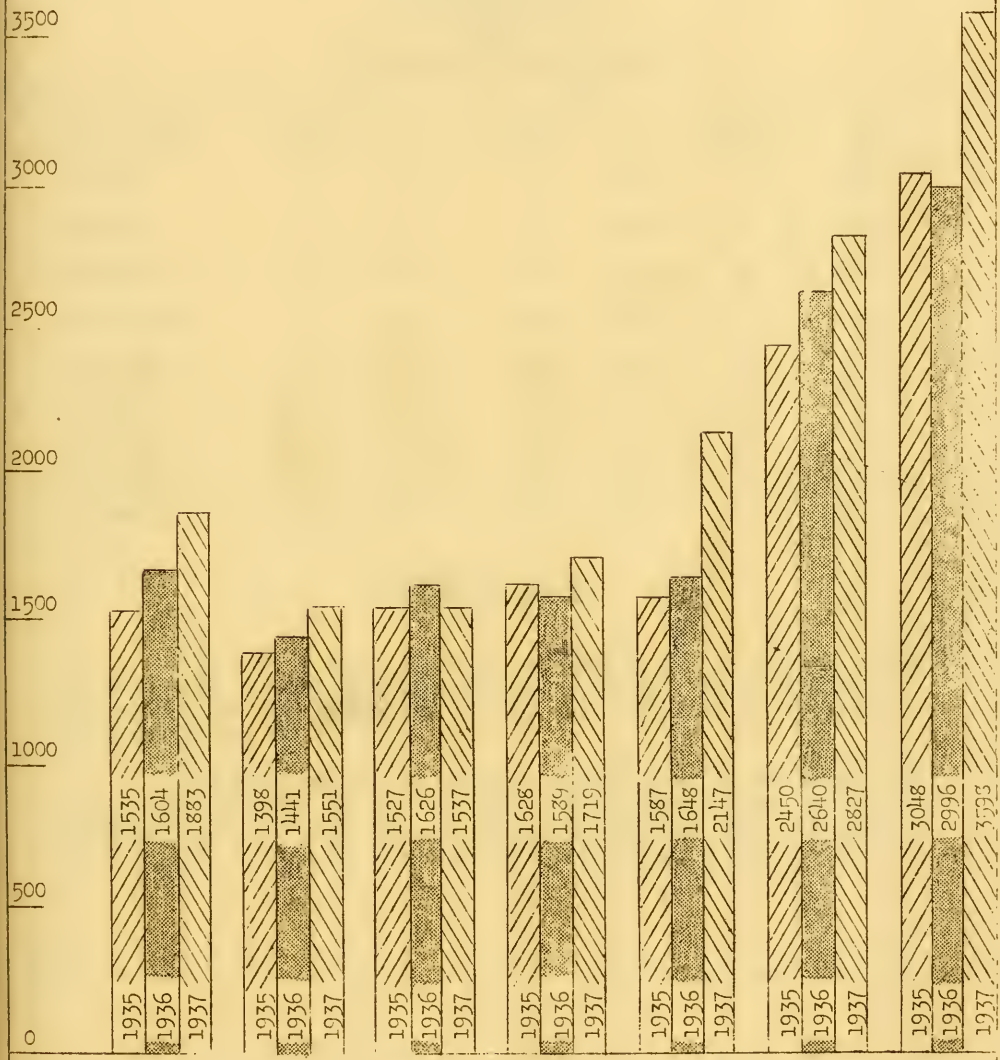
COMMENTS ON TABLE 8

This table shows Sunday to be the day of most injuries for each of the three years. Tuesday was the low day in 1935 and 1936. Wednesday was low day in 1937 with one-tenth of one per cent fewer injuries than Tuesday. Friday is growing steadily worse, due probably to the fact that more people start their week-end trips on Friday than formerly.

When Saturday and Sunday are combined they show the danger of week-end travel. These two days account for 41.7% of the injuries in 1935; 41.6% in 1936, and 42.0% in 1937.

CHART-8A

INJURIES BY DAY OF WEEK
A COMPARISON OF
YEARS 1935 1936 1937
FOR
MASS. NUMBERED ROUTES



SCALE 500 to 1"

Table 9

FATALITIES BY DAY OF WEEK
A COMPARISON OF
YEARS 1935-1936-1937
FOR
MASSACHUSETTS NUMBERED ROUTES

	1935		1936		1937	
DAY OF WEEK	TOTAL	%	TOTAL	%	TOTAL	%
Sunday	63	21.0	60	20.2	51	18.9
Monday	36	12.0	41	13.8	27	10.0
Tuesday	32	10.7	31	10.4	34	12.6
Wednesday	25	8.3	32	10.8	33	12.2
Thursday	29	9.7	31	10.4	32	11.9
Friday	39	13.0	33	11.2	37	13.7
Saturday	76	25.3	69	23.2	56	20.7
Totals	300	100.	297	100.	270	100.

COMMENTS ON TABLE 9

This table shows Saturday responsible for the greatest number of fatalities in each of the three years. The low day in 1935 was Wednesday; Tuesday and Thursday had the same low figure in 1936; in 1937 Monday was the low day.

Saturday and Sunday combined show 46.3% of the fatalities in 1935; 43.4% in 1936, and 39.6% in 1937. While these figures show the week-end to be the worst part of the week, they also show a decrease year by year in both the Saturday and the Sunday fatalities.

CHART - 9A

FATALITIES BY DAY OF WEEK
A COMPARISON OF
YEARS 1935 1936 1937
FOR
MASS. NUMBERED ROUTES

SCALE 10 to 1"

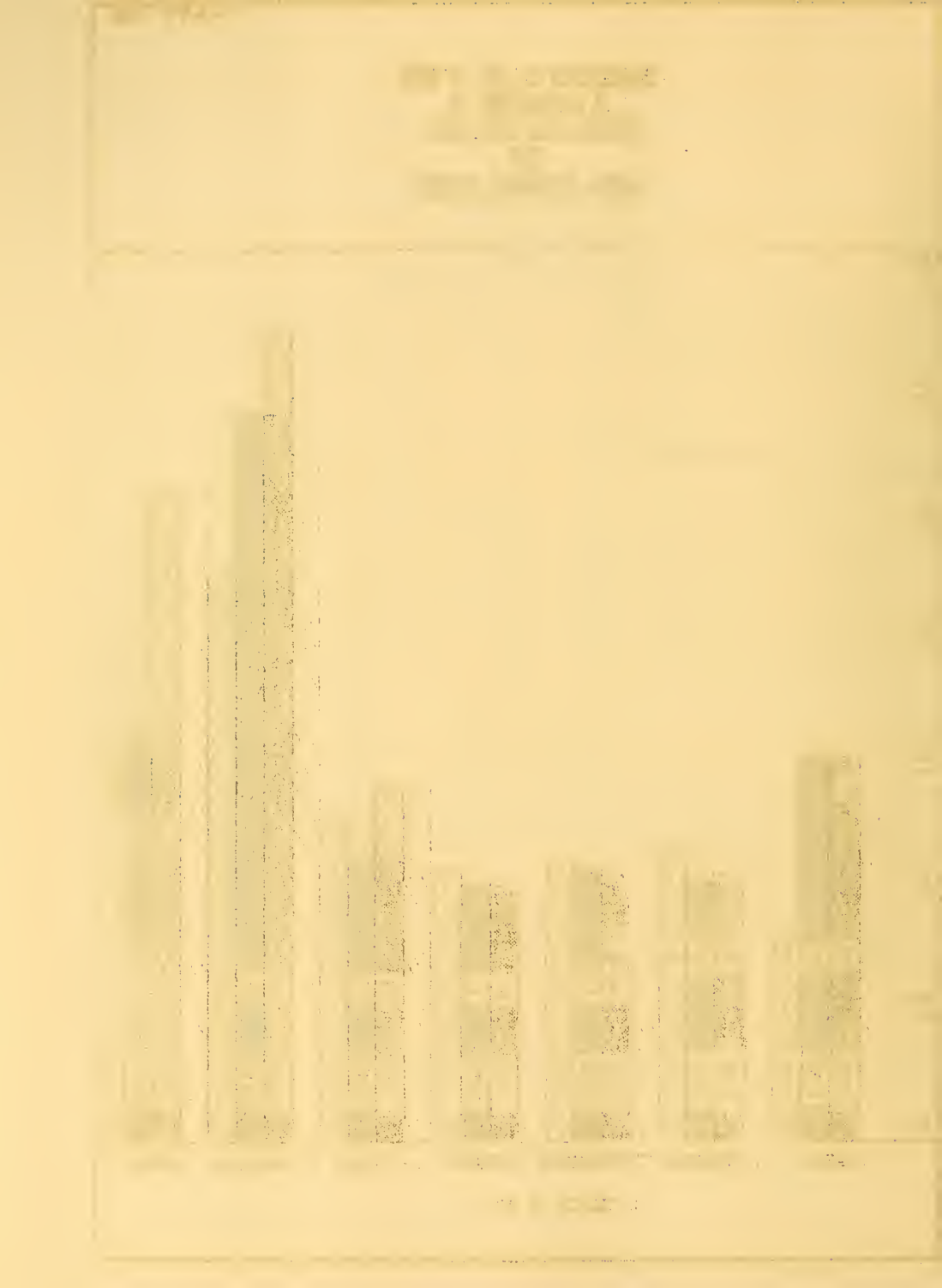


Table 10

PEDESTRIAN ACCIDENTS ON NUMBERED ROUTES IN MASSACHUSETTS FOR YEARS 1935-1936-1937

Yr.	Troop	Adults Involved No.	%	Adults Killed No.	%	Adults Injured No.	%	Children Involved No.	%	Children Killed No.	%	Children Injured No.	%	Not Recorded No.	%
1935	A	919	58.9	63	54.3	856	59.3	516	57.1	1	9.1	515	57.7	45	55.6
	B	199	12.8	20	17.2	179	12.4	116	12.9	4	36.3	112	12.6	23	28.4
	C	214	13.7	19	16.4	195	13.5	121	13.4	2	18.2	119	13.3	5	6.2
	D	227	14.6	14	12.1	213	14.8	150	16.6	4	36.4	146	16.4	8	9.8
	Total	1559	100.	116	100.	1443	100.	903	100.	11	100.	892	100.	81	100.
1936	A	974	59.5	53	44.5	921	60.6	466	57.5	14	51.9	452	57.7		
	B	240	14.6	30	25.2	210	13.8	119	14.7	5	18.5	114	14.6		
	C	204	12.5	14	11.8	190	12.5	103	12.7	6	22.2	97	12.4		
	D	220	13.4	22	18.5	198	13.1	122	15.1	2	7.4	120	15.3		
	Total	1638	100.	119	100.	1519	100.	810	100.	27	100.	783	100.		
1937	A	1069	64.9	53	53.0	1016	65.7	552	63.3	10	52.6	542	63.5		
	B	192	11.7	13	13.0	179	11.6	114	13.1	3	15.8	111	13.0		
	C	213	12.9	16	16.0	197	12.7	98	11.2	4	21.1	94	11.0		
	D	172	10.5	18	18.0	154	10.0	108	12.4	2	10.5	106	12.5		
	Total	1646	100.	100	100.	1546	100.	872	100.	19	100.	853	100.		

COMMENTS ON TABLE 10

The pedestrian situation is one of grave concern, particularly as it affects the children. The figures in this table show that something has been accomplished toward improving the pedestrian situation on the numbered routes of Massachusetts.

The figures show for 1937, an increase of 4.1% in accidents, an increase of 3% in the number of persons injured. On the face of it this may not seem to be an improvement, but when we realize that there are 5% more cars on the road, that they are using 9% more gasoline, which means more miles of travel, than in 1936, then we know that an actual gain has been made.

When we scan the fatality figures there is cause for rejoicing. We find a decrease of 18.4% from the previous year, while a further breakdown of these fatality figures show adult fatalities were reduced 19%, and the child fatalities 29.6%. It is only fitting to mention here that this last figure is primarily due to safety education in the schools.

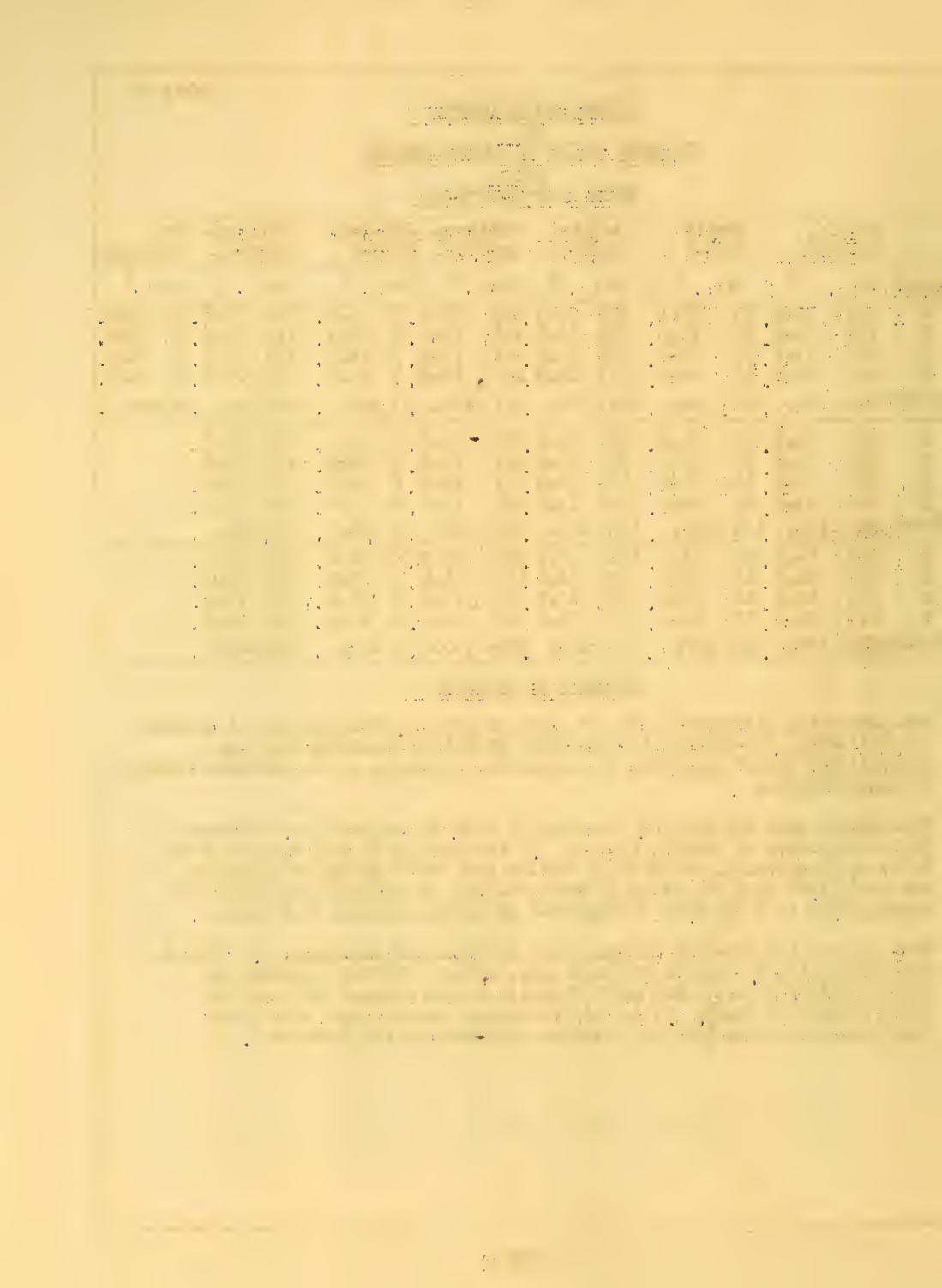


Table 11

CAUSES OF ACCIDENTS ON NUMBERED ROUTES IN MASSACHUSETTS 1935-1936-1937 A COMPARISON OF TROOP AREAS SHOWING PERCENTAGE OF EACH TROOP TO WHOLE AREA

CO-CAUSES

Yr.	Troop Area	Reckless Driving Accs.	%	Speed Accs.	%	Failed to Keep Rt. Accs.	%	Blow-Out Accs.	%	Glaring Lights Accs.	%	Obst. Vision Accs.	%	Cut-In Accs.	%	Careless Pedes. Accs.	%	Misc. Accs.	%	Drunken Driving Accs.	%	Skid Accs.	%
1935	A	1121	49.2	1276	56.3	429	57.0	46	43.4	55	41.7	101	56.4	219	64.0	996	61.2	1195	59.8	361	44.9	540	55.2
	B	352	15.4	479	21.1	131	17.4	24	22.6	31	23.5	17	9.5	48	14.1	169	10.4	269	13.5	182	22.6	176	18.0
	C	282	12.4	210	9.3	87	11.6	14	13.2	18	13.6	35	19.6	31	9.1	217	13.3	223	11.2	101	12.5	121	12.4
	D	523	23.0	303	13.3	105	14.0	22	20.8	28	21.2	26	14.5	44	12.8	245	15.1	309	15.5	160	20.0	142	14.4
	Total	2278	100.	2268	100.	752	100.	106	100.	132	100.	179	100.	342	100.	1627	100.	1996	100.	804	100.	979	100.
1936	A	1145	40.9	1392	58.9	644	61.0	33	45.2	34	43.0	58	50.4	403	84.7	1038	63.0	1087	62.0	348	43.4	543	51.7
	B	498	17.8	464	19.6	188	17.8	15	20.5	21	26.6	31	27.0	28	5.9	186	11.3	253	14.4	160	20.0	265	25.2
	C	191	6.8	370	15.7	147	13.9	15	20.6	16	20.2	17	14.8	35	7.3	214	13.0	242	13.8	118	14.7	133	12.7
	D	964	34.5	137	5.8	77	7.3	10	13.7	8	10.2	9	7.8	10	2.1	209	12.7	173	9.8	176	21.9	109	10.4
	Total	2798	100.	2363	100.	1056	100.	73	100.	79	100.	115	100.	476	100.	1647	100.	1755	100.	*802	100.	*1050	100.
1937	A	1255	50.4	1510	52.8	633	51.1					62	58.5	710	84.5	1236	69.3	3100	65.6	429	48.9	620	52.3
	B	462	19.0	515	18.0	243	19.6					13	12.3	57	6.8	166	9.3	676	14.3	194	22.1	279	23.5
	C	283	11.6	439	15.4	190	15.4					17	16.0	42	5.0	218	12.2	428	9.1	113	12.9	167	14.1
	D	460	19.0	395	13.8	172	13.9					14	13.2	31	3.7	163	9.2	519	11.0	141	16.1	120	10.1
	Total	2430	100.	2859	100.	1238	100.					106	100.	840	100.	1783	100.	4723	100.	877	100.	1186	100.

COMMENTS ON TABLE 11

Troop A can be generally classed as Urban territory; the other three troop areas, eliminating Worcester in C area and Springfield in B area, can be classed as Rural territory, in so far as the course of the numbered routes is concerned.

This table shows 46.5% of the accidents caused by reckless driving on Massachusetts numbered routes over a three year period; 56% of the accidents caused by speed, and 46% of the accidents involving drunken driving, were in area A.

The above percentages are important to the extent that they show where the violations are occurring, i.e. in what area, but they do not prove, for example, that area A is better or worse than area B, because the amount of traffic is vastly higher in area A than in area B, with a consequent higher number of violations. Table 11A shows the picture from another angle.

Table 11A

CAUSES OF ACCIDENTS ON NUMBERED ROUTES IN MASSACHUSETTS 1935-1936-1937

A COMPARISON OF TROOP AREAS

SHOWING PERCENTAGE OF EACH VIOLATION TO TOTAL VIOLATIONS

Troop Area	Year	Total Violation	Reckless Driving		Speed		Failed to Keep Rt.		Blow-out		Glaring Lights		Obst. Vision		Cut-In		Careless Pedes.		Misc.		Drunk Driving		Skid	
			Acc.	%	Acc.	%	Acc.	%	Acc.	%	Acc.	%	Acc.	%	Acc.	%	Acc.	%	Acc.	%	Acc.	%	Acc.	%
	1935	6339	1121	17.7	1276	20.1	429	6.8	46	0.7	55	0.9	101	1.6	219	3.5	996	15.7	1195	18.8	361	5.7	540	8.5
A	1936	6725	1145	17.0	1392	20.7	644	9.6	33	0.5	34	0.5	58	0.9	403	6.0	1038	15.4	1087	16.1	348	5.2	543	8.1
	1937	9525	1225	12.9	1510	15.9	633	6.6	0	-	0	-	62	0.6	710	7.5	1236	13.0	3100	32.5	429	4.5	620	6.5
	1935	1878	352	18.7	479	25.5	131	7.0	24	1.3	31	1.6	17	0.9	48	2.6	169	9.0	269	14.3	182	9.7	176	9.4
B	1936	2109	498	23.6	464	22.0	188	8.9	15	0.7	21	1.0	31	1.5	28	1.3	186	8.8	253	12.0	160	7.6	265	12.6
	1937	2605	462	17.7	515	19.8	243	9.3	0	-	0	-	13	0.5	57	2.2	166	6.4	676	26.0	194	7.4	279	10.7
	1935	1339	282	21.1	210	15.7	87	6.5	14	1.1	18	1.3	35	2.6	31	2.3	217	16.2	223	16.7	101	7.5	121	9.0
C	1936	1498	191	12.7	370	24.7	147	9.8	15	1.0	16	1.1	17	1.1	35	2.3	214	14.3	242	16.2	118	7.9	133	8.9
	1937	1897	283	14.9	439	23.1	190	10.0	0	-	0	-	17	0.9	42	2.2	218	11.5	428	22.6	113	6.0	167	8.8
	1935	1907	523	27.4	303	15.9	105	5.5	22	1.2	28	1.5	26	1.4	44	2.3	245	12.8	309	16.2	160	8.4	142	7.4
D	1936	1882	964	51.2	137	7.3	77	4.1	10	0.5	8	0.4	9	0.5	10	0.5	209	11.1	173	9.2	176	9.4	109	5.8
	1937	2015	460	22.8	395	19.6	172	8.5	0	-	0	-	14	0.7	31	1.5	163	8.1	519	25.8	141	7.0	120	6.0

COMMENTS ON TABLE 11A

This table clearly shows that the most prevalent violations in all four areas are reckless driving, speed and drunken driving. These same violations are also the most serious.

The table shows to what extent these violations occur in the different troop areas:-

	Reckless Driver	Speed	Drunken Driving
Troop A -	15.4%	18.4%	5.0%
" B	19.9	22.1	8.1
" C	16.0	21.5	7.0
" D	33.5	14.4	8.2

All three areas show an improvement in reckless driving during 1937. The speed record is better in Troops A and B. The speed record in area D is growing worse. Drunken driving is showing less in all four troop areas. The careless pedestrian has the worst record in area A and the best in area B.

TRUCK ACCIDENTS
A COMPARISON OF
YEARS 1935-1936-1937
FOR
MASSACHUSETTS NUMBERED ROUTES

Result	YEAR	ACCIDENTS			KILLED			INJURED			PROPERTY DAMAGE ONLY		
		Total Auto Accs.	Truck Accs.	Per cent Of Truck To Total	Total On Routes	By Truck	Per cent Of Truck To Total	Total On Routes	By Truck	Per cent Of Truck To Total	Total On Routes	By Truck	Per cent Of Truck To Total
	1935	11296	2195	19.4	300	82	27.3	13173	2245	17.0	3269	779	23.8
	1936	11734	2064	17.6	297	67	22.5	13553	2077	15.3	3511	733	20.9
	1937	13372	1878	14.0	270	52	19.3	15273	1941	12.7	4718	674	16.1

Day of Wk.	YEAR	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1935	179 8.0%	309 14.0%	351 16.0%	325 14.8%	340 15.4%	325 14.8%	366 17.0%
	1936	167 8.1	283 13.7	328 15.9	311 15.1	300 14.5	303 14.7	372 18.0
	1937	157 8.4	265 14.1	276 14.7	260 13.8	264 14.1	314 16.7	342 18.2

MONTH	YEAR	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
	1935	239 10.9	262 12.0	137 6.2	173 7.9	133 6.0	160 7.3	200 9.1	175 8.0	169 7.7	192 8.7	184 8.4	171 7.8
	1936	159 7.7	217 10.5	131 6.4	158 7.6	158 7.6	159 7.7	176 8.5	201 9.8	146 7.1	174 8.4	193 9.4	192 9.3
	1937	84 4.5	77 4.1	94 5.0	169 9.0	150 8.0	162 8.6	177 9.4	228 12.1	159 8.5	208 11.1	163 8.7	207 11.0

Type	YEAR	HEAD ON	SIDE COLL.	SIDE SWIPE	REAR END	HIT PED.	FIXED OBJECT	OTHER TYPES
	1935	277 12.6	261 11.9	302 13.8	700 31.9	236 10.8	122 5.5	297 13.5
	1936	123 6.0	403 19.5	423 20.5	600 29.1	220 10.6	150 7.3	145 7.0
	1937	76 4.0	450 24.0	392 20.9	498 26.5	160 8.5	172 9.2	130 6.9

*Cause	YEAR	R. D.	D. D.	SPEED	SKID	FAIL TO KEEP RT.	BLOW OUT	GLARE LIGHTS	OBS'D VISION	CARELESS PEDES.	CUT IN	FATIGUE	INATT. DRIVER	MISC.
	1935	457 20.8	116 5.3	506 23.1	279 12.7	225 10.3	15 0.7	16 0.7	37 1.7	165 7.5	73 3.3	0		306 13.9
	1936	563 26.9	68 3.3	421 20.1	228 10.9	189 9.0	8 0.4	9 0.5	24 1.2	156 7.4	86 4.1	0		340 16.2
	1937	329 17.5	83 4.4	401 21.3	163 8.7	202 10.8	– –	.. ..	– –	102 5.4	144 7.7	21 1.1	366 19.5	313 16.7

NOTE: *Includes 28 Co-Causes D.D. 6 – Skid 22
1937 " 243 " " " " 83 " 163

COMMENTS ON TABLE 12

In making a comparative analysis of Table 12 showing truck accidents on Massachusetts numbered routes for the years 1935-36, and 37, it is pleasing to note the vast improvement shown each year in the number of truck accidents, fatalities and injuries.

This is even more outstanding when we consider the fact that all automotive accidents and injuries show an increase during this same period - fatalities alone showing a decrease.

Saturday each year produced the greatest number of accidents. Sunday, as would be expected, produced the lowest number of accidents.

February showed the greatest number of accidents during 1935. In 1936 and 1937 August was the heaviest month for accidents. The first three months of 1937 showed a drastic decrease in accidents, in fact, these three months are responsible for the major part of the year's decrease.

Rear-end accidents show the highest percentage - due largely to trucks stopping on the highways. Head-On and Pedestrian accidents show a decline which is very encouraging as these two types of accident are apt to result in fatalities.

Inattentive driving was not segregated until 1937, being previously classed under speed, or reckless driving. This segregation naturally reduces the number of accidents during 1937 classified under the last two causes. The importance of segregating inattentive drivers is shown by the figures which point to this cause as next in number to speed.

MONTHLY RECORD OF ACCIDENTS BY NUMBER
COMPARING MASS. RTES.-STATE OF MASS.-U.S.
YEARS 1935-1936-1937

Table 13

Yr.	Area	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1935	Rtes.	742	839	682	804	840	1043	1137	1165	1028	1007	1076	933
	Mass.	2889	3193	2309	2751	2846	3281	3757	3945	3385	3744	3933	4105
	U.S.	57204	53906	63914	57204	60090	62334	69845	76967	76142	84570	80860	83654
1936	Rtes.	673	681	559	760	914	980	1248	1322	1039	1114	1212	1231
	Mass.	2721	2759	2206	2591	3134	3653	3704	3792	3397	3614	3872	3567
	U.S.	59708	45086	53314	57193	64057	67489	74588	85566	81217	88080	90361	98141
1937	Rtes.	913	739	914	985	1103	1172	1209	1399	1098	1355	1177	1308
	Mass.	2970	2302	2964	3275	3550	3765	3993	4163	3643	4264	3987	3531
	U.S.	69492	58486	62609	59571	65864	65647	74979	79969	80403	92122	81057	89951

MONTHLY RECORD OF ACCIDENTS BY PERCENTAGE

Table 13A

1935	Rtes.	6.6	7.4	6.1	7.1	7.5	9.2	10.0	10.3	9.1	8.9	9.5	8.3
	Mass.	7.2	7.9	5.7	6.83	7.1	8.2	9.34	9.84	8.45	9.34	9.8	10.3
	U.S.	6.9	6.5	7.7	6.9	7.3	7.6	8.5	9.3	9.2	10.2	9.8	10.1
1936	Rtes.	5.7	5.7	4.8	6.7	7.8	8.3	10.6	11.3	8.8	9.5	10.3	10.5
	Mass.	6.9	7.1	5.6	6.6	8.1	9.4	9.5	9.7	8.7	9.3	9.9	9.2
	U.S.	6.9	5.2	6.2	6.6	7.4	7.8	8.6	9.9	9.4	10.2	10.4	11.4
1937	Rtes.	6.8	5.5	6.8	7.4	8.3	8.8	9.0	10.5	8.2	10.1	8.8	9.8
	Mass.	7.0	5.4	7.0	7.7	8.4	8.9	9.4	9.8	8.6	10.1	9.4	8.3
	U.S.	7.9	6.6	7.1	6.8	7.5	7.5	8.5	9.1	9.1	10.5	9.2	10.2

COMMENTS ON TABLE 13

The month of greatest number of accidents is August on the numbered routes of Massachusetts, for each of the three years. In the whole State of Massachusetts it was August in 1935, November in 1936, and October in 1937. In the United States as a whole it was October in 1935 and 1937, with December in 1936.

The month of least number of accidents is March on both the numbered routes of Massachusetts and the whole State of Massachusetts for the years 1935 and 1936. In 1937 it was February for both areas. The United States as a whole shows February to be the best month for all three years.

The numbered routes of Massachusetts cover 3,309 miles, the State of Massachusetts about 24,000 miles, and the highways of the United States about 3,300,000 miles.

ACCIDENTS BY DAY OF WEEK
A COMPARISON OF
YEARS 1935-1936-1937
FOR
MASS. NUMBERED ROUTES-STATE OF MASS.-U. S.

Table 14

Yr.	Area	Mon.		Tues.		Wed.		Thurs.		Fri.		Sat.		Sun.		Total		
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
1935	Rtes.	1422	12.6	1314	11.6	1384	12.3	1468	13.0	1512	13.4	2102	18.6	2090	18.5	11292	100	*
	State	5387	13.4	4767	11.8	5220	13.2	5660	14.0	5705	14.3	7738	19.2	5661	14.1	40138	100	
	U.S.	106640	12.9	104990	12.7	102510	12.4	104990	12.7	114910	13.9	149630	18.1	143020	17.3	826690	100	
1936	Rtes.	1400	11.9	1376	11.7	1458	12.4	1485	12.7	1583	13.5	2198	18.8	2225	19.0	11725	100	*
	State	5270	13.5	5203	13.3	5045	12.9	4928	12.6	5489	14.1	7283	18.7	5792	14.9	39010	100	
	U.S.	111560	12.9	102050	11.8	108970	12.6	110699	12.8	121070	14.0	160858	18.6	149610	17.3	864800	100	
1937	Rtes.	1701	12.7	1528	11.5	1457	10.9	1653	12.4	1925	14.4	2503	18.7	2596	19.4	*13353	100	
	State	5654	13.3	4918	11.6	5282	12.5	5468	12.9	6183	14.6	8077	19.0	6825	16.1	42407	100	
	U.S.	113972	13.0	100174	11.4	104877	11.9	110375	12.5	124945	14.2	164452	18.7	161355	18.3	880150	100	

*1935 - 4 Accidents not classified
1936 - 8 " " "
1937 - 9 " " "

COMMENTS ON TABLE 14

This table shows that Saturday was the worst day in the week in all three areas during the year of 1935. In 1936 Saturday was the worst day in the whole of Massachusetts and also the United States, but Sunday was the worst day on the numbered routes by a small margin. Saturday again was the worst day in 1937 in the whole of Massachusetts and in the United States, with Sunday again the worst day on the numbered routes.

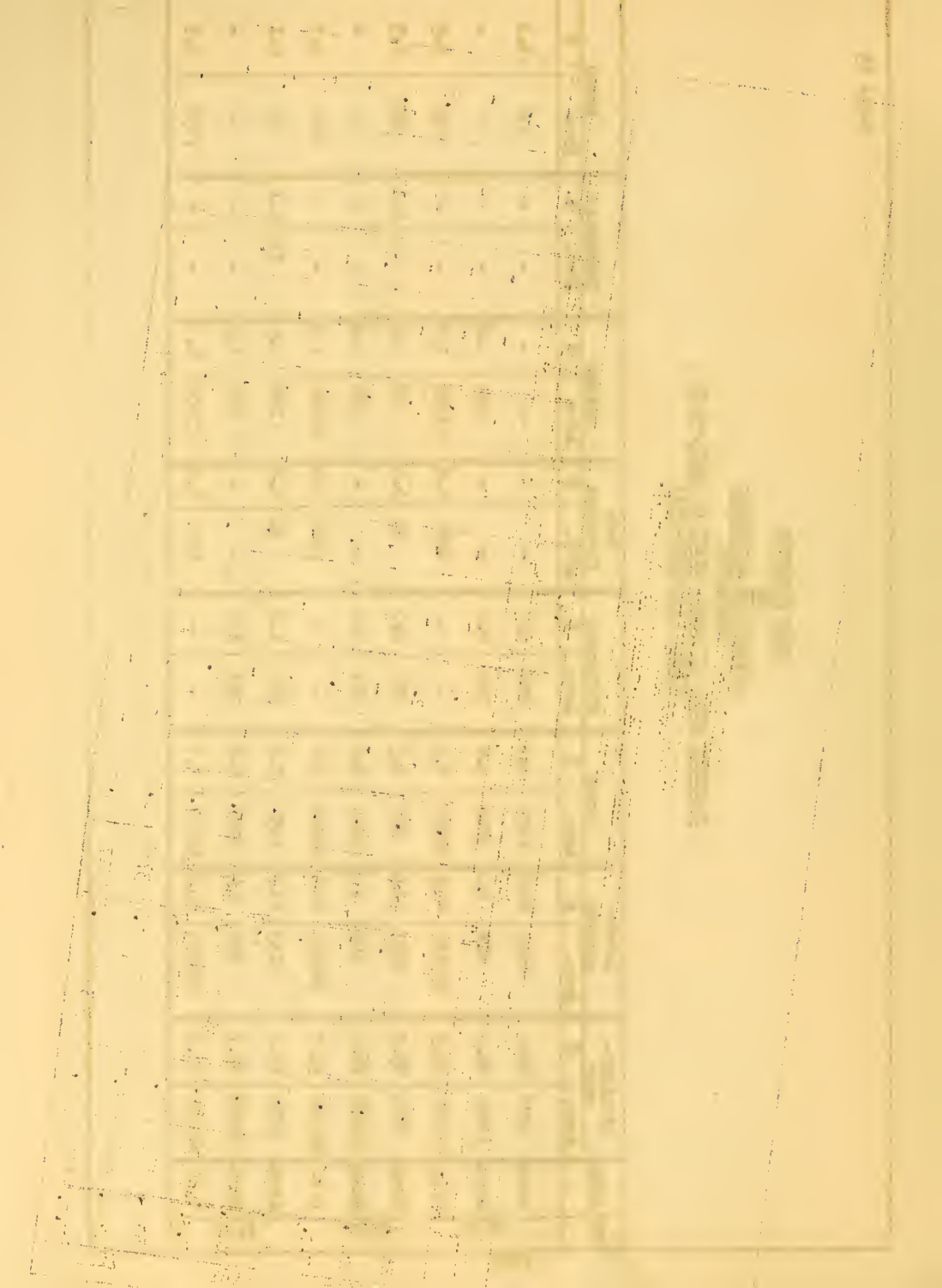
The best day of the week was Tuesday on the numbered routes of Massachusetts and Massachusetts as a whole, with Wednesday the best day for all of the United States for the year 1935. In 1936 Tuesday was the best day on the numbered routes and in the whole of the United States, with Thursday the best day in the whole of Massachusetts. Tuesday was the best day in 1937 in the whole of Massachusetts and in the whole of the United States, with Wednesday the best day on the numbered routes.

Combining Saturday and Sunday shows week-end conditions to be the worst of the week, and steadily growing worse in all three areas. The record is higher for the week-end on the numbered routes than in either of the other areas. In 1935 the week-end record of the numbered routes was 37.1%; the State of Mass. 33.3% and the U.S. 35.4%. In 1936 it was Routes 37.8%; the State of Massachusetts 33.6%; and the U.S. 35.9%. In 1937 it was Routes 38.1%; the State of Mass. 35.1%; and the U.S. 37.0%.

Table 15

ROAD LOCATION
OF
AUTOMOBILE ACCIDENTS
COMPARING
NUMBERED RTES. OF MASS.-STATE OF MASS.-U.S.
YEARS 1935-1936-1937

YR	AREA	Straight-away		Inter-section		Curve		Hillcrest		R.R. Crossing		Bridge		Underpass		Misc.	
		Accs.	%	Accs.	%	Accs.	%	Accs.	%	Accs.	%	Accs.	%	Accs.	%	Accs.	%
1935	Rtes.	5202	46.1	4633	41.0	1039	9.2	286	2.5	-	-	-	-	-	-	136	1.2
	Mass.	34615	86.0	818	2.0	3782	9.4	799	2.0	-	-	251	0.6	-	-	-	-
	U.S.	432360	52.3	333150	40.3	40510	4.9	-	-	4960	0.6	11580	1.4	-	-	4130	0.5
1936	Rtes.	5305	45.2	4993	42.6	974	8.3	234	2.0	16	0.1	46	0.4	14	0.1	152	1.3
	Mass.	33476	86.0	506	1.3	3713	9.5	774	2.0	-	-	470	1.2	-	-	-	-
	U.S.	456970	51.7	349510	40.4	46700	5.4	-	-	5190	0.6	10380	1.2	-	-	6050	0.7
1937	Rtes.	5754	43.1	6113	45.7	1050	7.9	246	1.8	36	0.4	126	0.9	18	0.1	20	0.1
	Mass.	34346	85.7	562	1.4	3786	9.5	763	1.9	-	-	610	1.5	-	-	-	-
	U.S.	448323	50.9	353403	40.2	52170	5.9	-	-	6911	0.8	11509	1.3	-	-	7834	0.9



COMMENTS ON TABLE 15

This table brings out very forcibly that the majority of the accidents are occurring on the straight open road for which there is little excuse. This is followed, in number, by accidents at intersections for which again there is little excuse, as a large percentage of these intersections are safeguarded by either stop signs, traffic lights, traffic lanes, or officers.

The numbered routes show 45% of all accidents occur on the straightaway, with about 43% at intersections, and in the United States as a whole 52% of the accidents occur on the straightaway, with about 40% at intersections. Straightaways and intersections combined on all roads of Massachusetts show about the same average as the above figures.

Table 16

TYPE OF ACCIDENT BY NUMBER
COMPARISON OF MASS.-RTES.-STATE OF MASS.-U.S.
FOR YEARS 1935-1936-1937
COLLISIONS

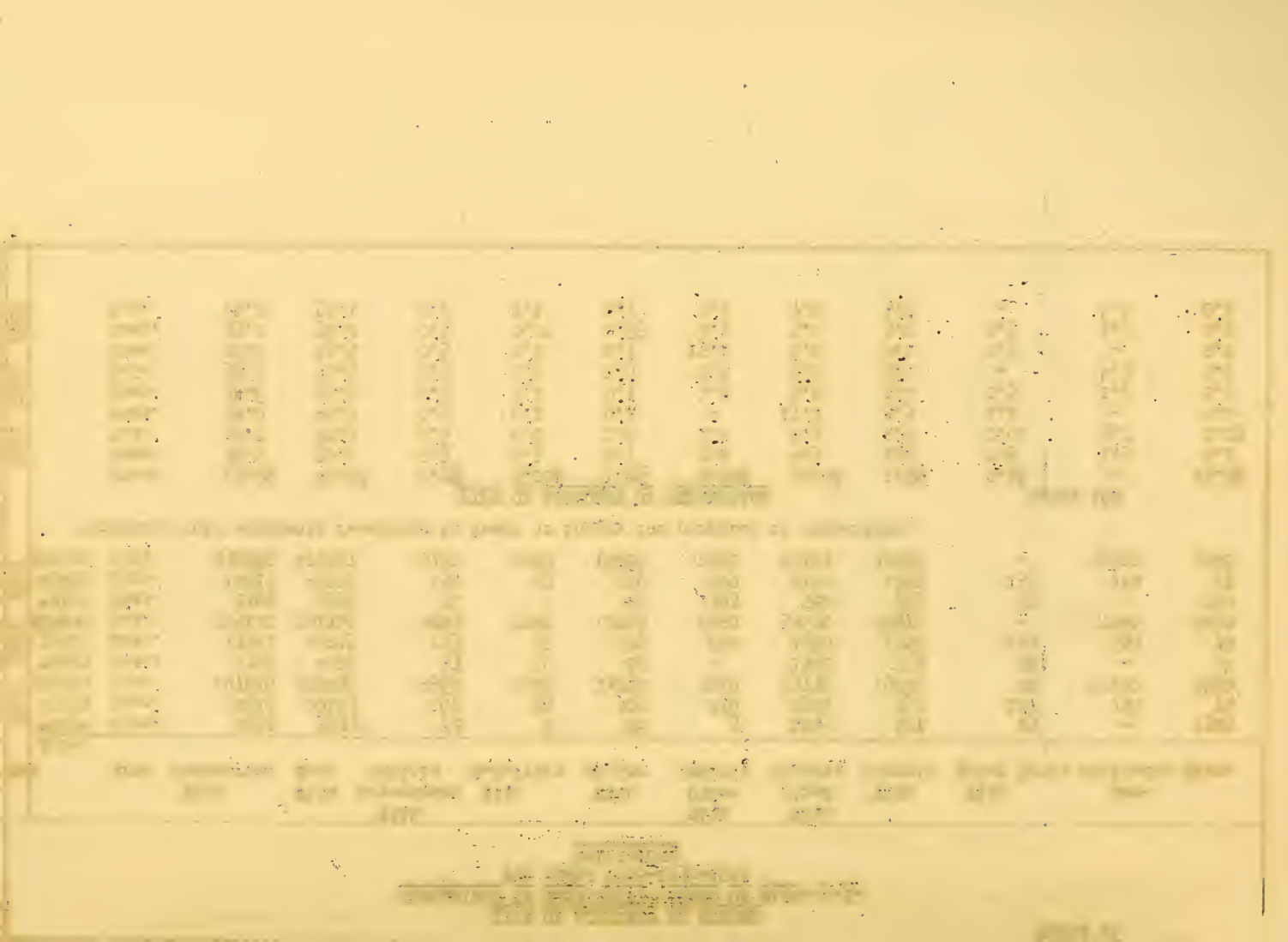
Yr.	Area	With Pedestrian	With Auto	With Horsedrawn Vehicle	With R.R.Train	With St.Car	With Other Vehicle	With Fixed Objects	With Bicycle	With Motor Cycle	Non-Collision	Misc.
Accs.												
1935	*8194 Rtes.	1553	3933	72	6	86	3	1014	147	75	-	1305
	40138 Mass.	14619	20143	197	29	305	876	1961	997	187	754	70
	326690 U.S.	297610	374490	4960	4960	13230	8270	53730	19840	88	47120	2480
1936	*8223 Rtes.	2305	4020	43	10	68	-	1402	273	88	-	14
	39010 Mass.	13511	20215	153	27	279	690	1860	1350	199	650	76
	364800 U.S.	319110	391760	4820	7580	12910	6920	53620	24970	-	37060	6050
1937	*9190 Rtes.	2399	3996	51	6	63	1393	568	375	79	-	260
	42407 Mass.	14019	22986	131	23	275	209	2140	1628	195	714	87
	380150 U.S.	230865	476157	5720	9200	14860	2922	65187	32660	-	39033	3546

*Includes only accidents resulting in death or injury for purposes of comparison.

Table 16A

TYPE OF ACCIDENT BY PERCENTAGE

1935	Rtes.	19.0%	48.0%	0.9%	0.06%	1.0%	0.04%	12.4%	1.8%	0.9%	-	15.9%
	Mass.	36.5	50.0	0.5	0.1	0.7	2.2	4.9	2.5	0.5	1.9	0.2
	U.S.	36.0	45.3	0.6	0.6	1.6	1.0	6.5	2.4	0.01	5.7	0.29
1936	Rtes.	28.0	48.9	0.5	0.1	0.8	-	17.1	3.3	1.1	-	0.2
	Mass.	34.6	51.8	0.4	0.1	0.7	1.8	4.8	3.4	0.5	1.7	0.2
	U.S.	36.9	45.3	0.5	0.9	1.5	0.8	6.2	2.9	-	4.3	0.7
1937	Rtes.	26.1	43.5	0.5	0.1	0.7	15.1	6.2	4.1	0.9	-	2.8
	Mass.	33.1	54.2	0.3	0.05	0.65	0.5	5.0	3.8	0.5	1.7	0.2
	U.S.	26.2	54.1	0.7	1.1	1.7	0.3	7.4	3.7	-	4.4	0.4



COMMENTS ON TABLE 16

This table shows that of all the traffic accidents in the three year period, accidents involving Pedestrians and Bicycles contributed about 36% of the total accidents, when separated by type of accident. The numbered routes of Massachusetts show Pedestrian Accidents to be 24.5% of the total accidents; the whole State of Massachusetts shows 34.6%; and the United States as a whole 33%.

Bicycle accidents on the numbered routes increased 37.4% in 1937; in the whole of Massachusetts they increased 20.6%; and in the United States as a whole they increased 30.4%.

Combining Pedestrian and Bicycle accidents shows 27.5% for the numbered routes, 37.9% for the State of Massachusetts, and 36% for the whole United States.

Table 17

VEHICLES INVOLVED IN 1935-1936-1937 ACCIDENTS ON NUMBERED ROUTES-STATE OF MASS.-U.S.

TYPE OF VEHICLE	NUMBERED ROUTES						STATE OF MASS.						UNITED STATES					
	1935		1936		1937		1935		1936		1937		1935		1936		1937	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Passenger Car	16170	84.3	17048	85.2	19895	86.6	47901	79.9	47147	80.5	51835	80.1	962760	77.6	1018080	77.1	1081960	78.1
Trucks	2394	12.5	2254	11.3	2299	10.0	7606	12.7	7168	12.2	8310	12.9	155560	12.5	169700	12.9	159470	11.5
Buses	197	1.0	181	0.9	180	0.8	379	0.63	428	0.73	413	0.63	14710	1.2	18830	1.4	18380	1.3
Motor Cycle	75	0.4	88	0.44	79	0.34	193	0.3	204	0.3	199	0.3	17030	1.4	18060	1.4	20070	1.4
Bicycle	147	0.8	273	1.4	375	1.6	997	1.7	1350	2.3	1628	2.5	19840	1.6	24970	1.9	32660	2.4
Train	6	0.03	10	0.05	6	0.03	29	0.05	27	0.05	23	0.04	4960	0.4	7580	0.6	9200	0.7
Trolley	86	0.45	68	0.31	63	0.27	305	0.5	279	0.5	275	0.4	13230	1.1	12910	0.9	14860	1.1
Horsedrawn Vehicle	72	0.36	43	0.2	51	0.22	197	0.3	153	0.3	131	0.2	4960	0.4	4820	0.4	5720	0.4
Taxi	27	0.14	26	0.13	33	0.14	612	1.02	533	0.9	485	0.8	44310	3.5	42110	3.2	40030	2.9
Steam Roller	3	0.02	-	-														
Not Recorded			14	0.07			1656	2.8	1217	2.1	1309	2.0						
Fire-Trucks							24	0.04	38	0.06	42	0.07						
Ambulance							33	0.06	35	0.06	37	0.06						
All Others													3590	0.3	2580	0.2	2690	0.2
Totals	19177		20005		22981		59932		58519		64687		1240950		1319640		1385040	

COMMENTS ON TABLE 17

This table shows quite a uniformity of percentages for the three areas.

On the numbered routes there is a gradual decrease in the number of trucks and buses involved in accidents. Horse drawn vehicles involved in accidents show a decrease over the three year period on the numbered routes of Massachusetts, and in Massachusetts as a whole, but this is not true of the United States as a whole, - 1937 showing a material increase in this type of accident.

Bicycles are becoming a serious problem on our highways. Table 16 shows the percentage of increase in bicycle accidents on the numbered routes of Massachusetts. The State of Massachusetts as a whole shows an increase of over 20% in bicycle accidents for 1937, and the United States shows an increase of over 30% in bicycle accidents for 1937.

WEATHER CONDITIONS
IN RELATION TO ACCIDENTS
NUMBERED ROUTES OF MASS.-STATE OF MASS.-U.S.
YEARS 1935-1936-1937

Yr.	Area	Clear		Cloudy		Rain Or Snow		Fog Or Mist		Misc. & Not Recorded	
		Accs.	%	Accs.	%	Accs.	%	Accs.	%	Accs.	%
1935	Rtes.	7480	66.2	449	4.0	1477	13.1	529	4.7	1361	12.0
	Mass.	30241	74.8	2444	6.0	5905	14.64	1800	4.4	26	0.06
	U.S.	699710	84.6	-	-	111040	13.5	15940	1.9	-	-
1936	Rtes.	7139	60.8	492	4.2	1566	13.4	485	4.1	2052	17.5
	Mass.	30059	77.1	2214	5.68	5015	12.8	1712	4.4	8	0.02
	U.S.	736140	85.1	-	-	115390	13.4	13270	1.5	-	-
1937	Rtes.	8063	60.3	646	4.8	2216	16.6	512	3.8	1935	14.5
	Mass.	29203	71.7	2320	5.7	7067	17.37	2122	5.2	13	0.03
	U.S.	717870	81.6	-	-	147910	16.8	14370	1.6	-	-

COMMENTS ON TABLE 18

This table shows over 62% of the accidents on the numbered routes occurred in clear weather during the three year period. The State of Massachusetts as a whole shows about 74% and the United States shows almost 84% of the accidents occurred during clear weather. It is not the clear weather that causes the accidents, but the behavior of the motorist, who in clear weather is less careful and takes greater chances.

All three areas show an improvement for 1937, which is gratifying. The figures also show that the numbered routes carry a lower percentage of accidents occurring in clear weather than do either of the other areas.

ROAD CONDITIONS
IN RELATION TO ACCIDENTS
NUMBERED RTES. OF MASS.-STATE OF MASS.-U.S.
YEARS 1935-1936-1937

Yr	Area	Dry		Wet		Snow		Ice		Misc.		Not Recorded	
		Accs.	%	Accs.	%	Accs.	%	Accs.	%	Accs.	%	Accs.	%
1935	Rtes.	6811	68.3	1834	16.2	505	4.5	884	7.8	27	0.3	1235	10.9
	Mass.	26535	55.7	9219	19.3	5587	11.7	6261	13.2	53	0.1	-	-
	U.S.	619930	75.0	136830	16.6	23970	2.9	45960	5.5	-	-	-	-
1936	Rtes.	6677	57.0	1872	15.7	298	2.6	945	8.1	-	-	1942	16.6
	Mass.	26915	60.2	8888	19.8	4070	9.1	4723	10.5	123	0.3	-	-
	U.S.	645650	74.6	135870	15.7	30860	3.6	52420	6.1	-	-	-	-
1937	Rtes.	8013	59.9	2636	19.7	317	2.4	566	4.2	-	-	1840	13.8
	Mass.	28876	71.5	8943	22.1	1100	2.7	1227	3.0	69	0.2	192	0.5
	U.S.	673050	76.5	171860	19.5	14080	1.6	21160	2.4	-	-	-	-

COMMENTS ON TABLE 19

This table shows that on the numbered routes, over a three year period, about 59% of the total accidents occurred on dry roads; in the State of Massachusetts as a whole about 62% of the accidents occurred on dry roads, and in the United States as a whole about 75% of the accidents occurred on dry roads. Here again the percentage is lower on the numbered routes, as it is on Table 18, than on the other two areas.

Studying Tables 15, 18, and 19 together it is very apparent that the bulk of our accidents occur under the best of conditions - on straightaways, dry roads and in clear weather. Certainly good roads, good weather, and good automobiles are not reasons for accidents. The trouble is obviously with the driver.

V MOTOR TRAFFIC VIOLATION RECORD ANALYSIS

1 GENERAL BASIC CONSIDERATIONS

In this report the use of data gathered by the several field crews indicating how motor vehicle drivers recognize, and conform to, traffic and driving regulations, must be read with certain limitations kept constantly in mind.

Certain observations are subject to an exact interpretation - a driver either stops for a red traffic light or he doesn't; he either makes a turn from the proper lane or the wrong lane. Some violations are a matter of personal judgment - a driver may appear to the observer to have passed recklessly through an intersection, while to another he appears to have passed safely. In the latter case, as distinct from the former case, his action is subject to the interpretation of the given observer based on the conditions then and there prevailing. Every effort was made to have as uniform interpretations as could be devised applied to all observations by our field men.

We admit the limitations in the second case. We also feel that, since most of our observers have been making these observations for a long time (some for over three years) and since our observations cover the drivers of over 21 million cars, these errors are virtually averaged out of the picture.

Moreover, our supervisors have been repeatedly instructed in joint conferences, where all were considering the same limitations, as to how these violations that are subject to a variable interpretation within the limits of human fallibility, should be recorded. We do not deem this matter of more importance than to record it or that, in the now considerable mass of facts, it introduces any need for adjustment.

In speed records taken by the electric device we have the maximum of accuracy of observation, both of volume and of speed. The Eno speed recorder, used only in lightly travelled locations, still secures for the cars recorded with it, a reasonably accurate record of speed. It has been used long enough so that the human errors of observation and of timing, as in the case of other violations, is reasonably averaged out, thus making any irreducible error small and constant. Such an error does not, by its presence, vitiate our records or any deductions drawn from them.

2 VIOLATIONS STUDIES COVERED

For the reader to secure a basis upon which to appraise the facts set forth hereafter, with respect to driver behavior, a brief summary of the items observed by the field crews is given here. The whole purpose of such observations represented an effort to record only those violations which, by their nature and their prevalence, as determined from a consideration of the principal recorded causes, resulted in death and injury. Such violations are subject to control and reduction eventually by enforcement, or by changes in the physical features of the highway or the equipment used in connection therewith. The principal purpose of each type of study is as follows:

(a) Volume (V) - The basis for measuring the extent of any violations recorded is the number of such violations in any given volume of traffic. In each study, therefore, volume is taken separately where the violation items, as set up in the form used, do not themselves give volume by totalling such items.

(b) Driving Violations (D) - These studies were designed to detect cars creating hazards by making turns across traffic from a wrong lane, failing to keep in proper lanes or the proper side of the center of the road, cutting in or out recklessly and passing on wrong side. Such records, because they concern cars in motion, show violations of a more dangerous nature.

(c) Stop Sign Observance (S) - Under this head, studies were made to ascertain to what extent Stop, and Stop-and-Go, signs were affording protection to the Through Traffic they were supposed to protect and to what extent interference, due to the presence of Through Traffic, altered observance of the sign.

(d) Traffic Signal Violations - Vehicular (T) - Vehicles observed under this study were both static and mobile. It was designed to show what action of drivers, when approaching, stopping for and leaving traffic signals, was contributing to accidents.

(e) Traffic Signal Violations - Pedestrian (P) - Such studies cover locations where traffic light protection is afforded. It is a study related to, and taken with, studies of Vehicular Traffic Signal Obedience (T) in (d) above, but only when the pedestrian movement is large in proportion to vehicle movement or desired for special studies.

(f) Speed Observations (HO) - Under this head HO Studies are taken to gain information as to the speed of approach of vehicles to hazards, or through them, or by studies concerning the speed of the mass of traffic when flowing without interruption on open highways. The type of recording device used, whether the electric meter or stop watch and Eno device, depends on the volume to be recorded.

3 BASIS FOR VIOLATION COMPARISONS

The field studies were made by actual observation in the field. These were at once forwarded to the home office where they were analyzed, compiled, and correlated with the accident reports in order to determine to what extent, and how, motor-vehicle laws are being violated. Some type of field study was made in 206 of the 355 towns and cities of the State.

Based on the total number of 8,970,702 motor vehicle drivers and 306,546 pedestrians observed under the 15,000 studies made at 788 different locations on 3309 miles of State and Numbered Highways under any of the general types of study above listed, tables shown herewith have been compiled for use in drawing conclusions and making recommendations.

Volume studies always are taken in conjunction with driving violations, vehicular traffic signal obedience, and speed studies, as a basis for percentages of violation and to give the directions of traffic movement committing the recorded violations. The stop sign studies constituted their respective volumes. In Volume Count Studies alone, we observed approximately 84 million cars.

Table 20

DRIVING VIOLATIONS

SEASONAL COMPARISONS

OCT. 1, 1934 to SEPT. 21, 1937 NUMBERED ROUTES IN MASS.

PERIOD COVERED FROM TO	TOTAL VOLUME	TOTAL VIOLATIONS	PERCENTAGE VIOLATIONS
Oct. 1, 1934 - Dec. 20, 1934	600,208	100,610	16.7
Dec. 21, 1934 - Mar. 21, 1935	581,511	119,689	20.5
Mar. 22, 1935 - June 21, 1935	760,520	101,273	13.3
June 22, 1935 - Sept. 21, 1935	2,284,794	105,109	4.6
Sept. 22, 1935- Dec. 21, 1935	1,344,994	85,572	6.37
Dec. 22, 1935 - Mar. 21, 1936	1,216,300	81,839	6.7
Mar. 22, 1936 - June 21, 1936	2,227,726	103,144	4.63
June 22, 1936 - Sept. 22, 1936	1,615,385	70,107	4.34
Sept. 23, 1936- Dec. 31, 1936	1,368,771	58,446	4.27
Jan. 2, 1937 - Mar. 31, 1937	1,138,758	58,134	5.11
Apr. 1, 1937 - June 30, 1937	1,677,884	62,289	3.7
July 1, 1937 - Sept. 21, 1937	1,354,542	59,708	4.41
TOTALS	16,171,393	1,006,000	6.22

COMMENTS ON TABLE 20

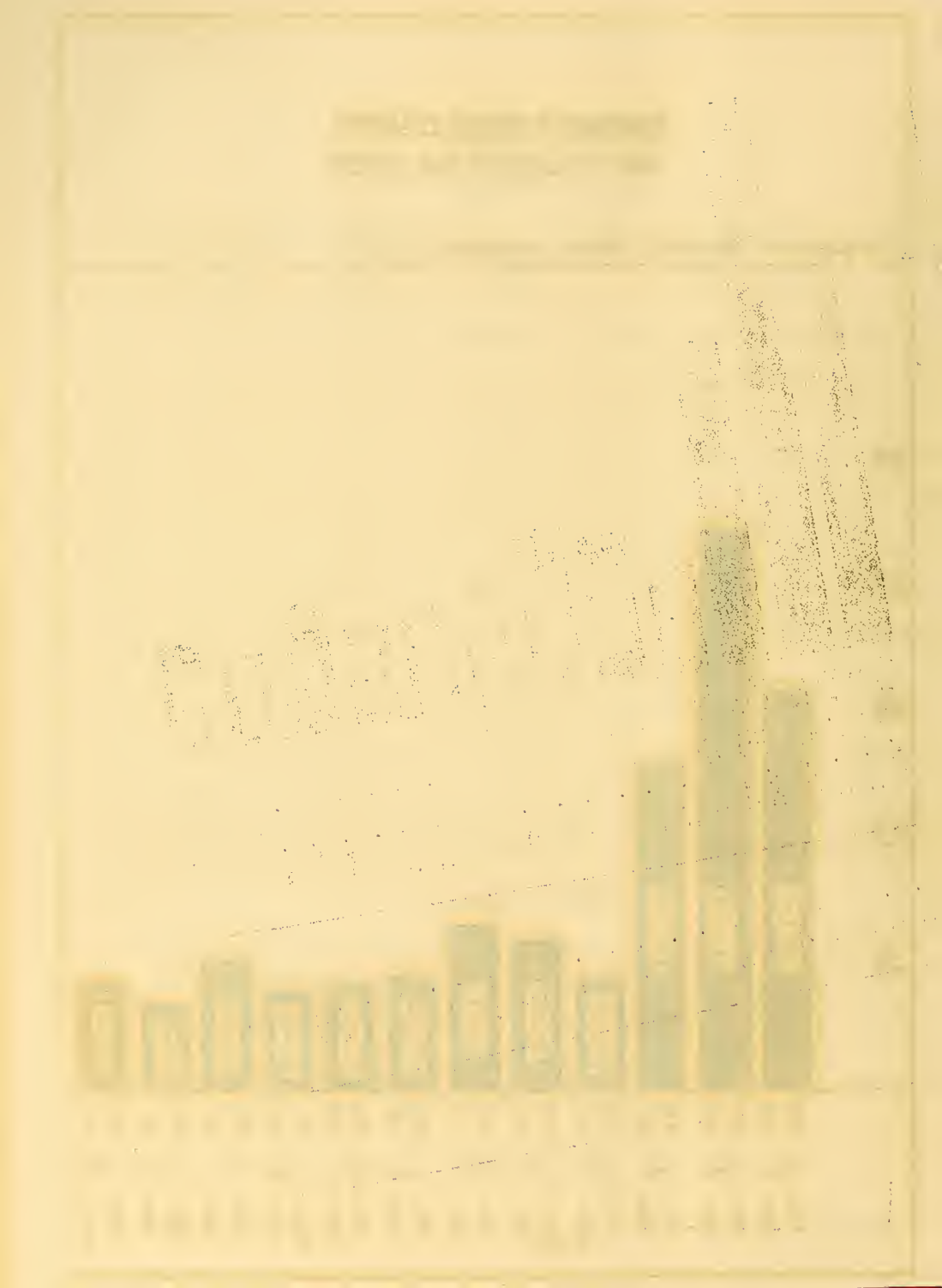
In June 1935 the following violations were eliminated-"No Signal", "Stopping on Pavement", and "Following too Closely". The following September "Following too Closely" was restored and "Excessive Speed" was added. These changes to a great extent account for the drop in percentage for quarter ending 9/21/35, and again for the increase in the next quarter.

Violations tend to increase as the amount of traffic decreases. Notice that the winter quarters are the highest in violations for all three years.

PERCENTAGE OF DRIVING VIOLATIONS

BASED ON 16,000,000 CARS OBSERVED

By Quarters - October 1, 1934 to September 21, 1937



SPECIFIC DRIVING VIOLATIONS ON NUMBERED ROUTES OF MASS. YEARS 1935-1936-1937

	1935 VIOLATIONS			1936 VIOLATIONS			1937 VIOLATIONS		
	No.	% of Tot. Viol.	% of Volume	Violations	% of Viol.	% of Volume	Violations	% of Viol.	% of Volume
Excessive Speed	21578	5.3	.4	76174	31.4	1.55	57947	32.17	1.39
Left of Center Line at Hazard	63784	15.7	1.3	68706	21.9	1.07	36974	20.53	.89
Passing at Hazard	67321	16.6	1.4	50051	15.9	.78	32810	18.21	.80
Failed to Keep Right	79217	19.5	1.6	8747	2.9	.14	3064	1.70	.07
"U" Turn or Cutting Corner	94237	23.2	1.9	9443	3.0	.15	24265	13.47	.58
Cutting In or Out	10510	2.6	.2	5384	1.7	.08	2497	1.39	.06
Followed Too Closely	27876	6.9	.6	34012	10.8	.53	13460	7.47	.32
Turning From Wrong Lane	27150	6.7	.5	36872	11.8	.57	8032	4.46	.19
Passed on Right of Car	14276	3.5	.3	1800	.6	.03	1082	.60	.03
TOTALS	405940	100.0	8.2	313689	100.0	4.88	180131	100.0	4.32

COMMENTS ON TABLE 21

This table shows:-

13.9 cars out of every thousand guilty of excessive speed.
9.6 " " " " " fail to keep on right side of road.
8.0 " " " " " pass at a hazard.
5.9 " " " " " cut corners.
3.3 " " " " " follow too closely.
2.0 " " " " " turn from wrong lane.

Multiply these figures by the million and a half cars on our highways and we have about 65,000 drivers violating common sense safety.

Is it any wonder that we have more than 40,000 accidents a year?

VEHICULAR TRAFFIC SIGNAL VIOLATIONS

TOTAL VIOLATIONS-SEASONAL COMPARISON

NUMBERED ROUTES IN MASSACHUSETTS

BY QUARTERS OCT. 1, 1934 - SEPT. 21, 1937 QUARTER PERIOD COVERED	TOTAL VOLUME	TOTAL VIOLATIONS	PERCENT OF TOTAL VIOLATIONS
Oct. 1, 1934 - Dec. 20, 1934	54,364	3,849	7.08
Dec. 21, 1934 - Mar. 21, 1935	285,007	27,747	9.73
Mar. 22, 1935 - June 21, 1935	437,995	37,737	8.6
June 22, 1935 - Sept. 21, 1935	883,734	67,179	7.6
Sept. 22, 1935- Dec. 21, 1935	866,190	59,483	6.84
Dec. 22, 1935 - Mar. 21, 1936	694,237	61,934	8.92
Mar. 22, 1936 - June 21, 1936	934,379	61,669	6.6
June 22, 1936 - Sept. 22, 1936	622,949	36,131	5.8
Sept. 23, 1936- Dec. 31, 1936	673,646	39,071	5.8
Jan. 2, 1937 - Mar. 31, 1937	371,340	24,731	6.66
Apr. 1, 1937 - June 30, 1937	784,567	46,289	5.9
July 1, 1937 - Sept. 21, 1937	642,974	42,640	6.63
Totals	7,251,382	508,460	7.01

COMMENTS ON TABLE 22

This table shows the violations each year to be greatest in the winter quarter. There is a gradual improvement noticeable in these violations year by year. In each year the largest violations come at the same time that we have the lightest traffic, which would seem to indicate that drivers take their greatest chances when traffic is light.

PERCENTAGE OF VEHICULAR TRAFFIC SIGNAL VIOLATIONS

BASED ON 7,250,000 CARS OBSERVED

By Quarters

Mass. Numbered Routes

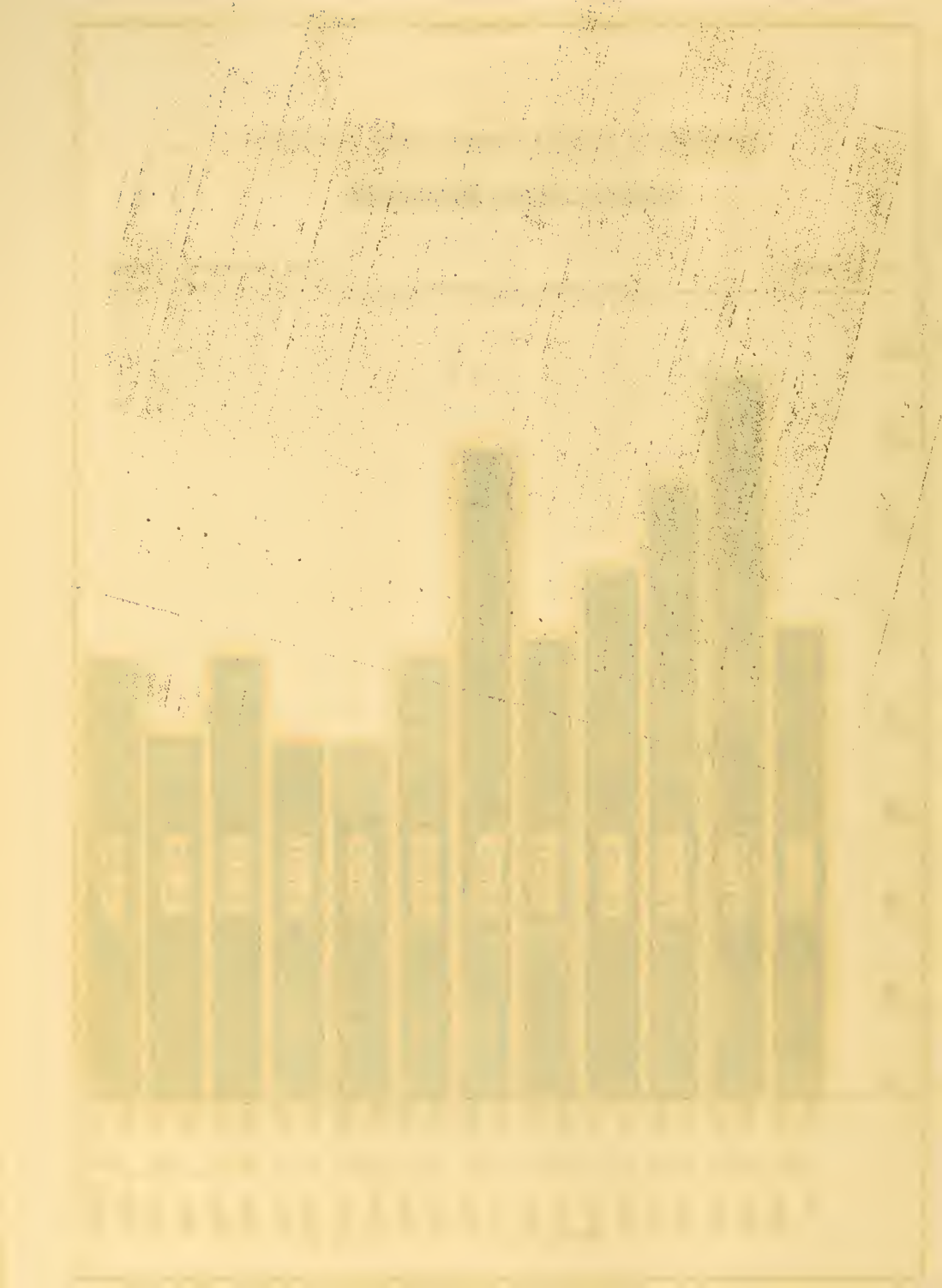


Table 23

VEHICULAR TRAFFIC SIGNAL VIOLATIONS
VIOLATIONS SEPARATED BY TYPE

BY QUARTERS — NUMBERED ROUTES MASSACHUSETTS

OCT. 1, 1934 to SEPT. 21, 1937

QUARTER PERIODS COVERED	Percent of Violations	Thru On Red	Thru On Red & Amber	Caught On Red	Started Too Early	Over-ran Stop Line
Oct. 1, 1934-Dec. 20, 1934	7.08	.2	.2	1.3	1.1	4.3
Dec. 21, 1934-Mar. 21, 1935	9.73	1.14	.25	1.15	.83	6.06
Mar. 22, 1935-June 22, 1935	8.65	.80	.05	2.10	1.00	4.70
June 22, 1935-Sept.21, 1935	7.60	.74	.36	.77	.62	5.11
Sept.22, 1935-Dec. 21, 1935	6.84	.81	-	.84	.72	4.47
Dec. 22, 1935-Mar. 21, 1936	8.92	.94	.20	.98	1.06	5.74
Mar. 22, 1936-June 21, 1936	6.81	.58	.10	1.03	.70	4.40
June 22, 1936-Sept.22, 1936	5.80	.64	.07	1.12	.45	3.52
Sept.23, 1936-Dec. 31, 1936	5.82	.67	.07	1.16	.41	3.51
Jan. 2, 1937-Mar. 31, 1937	6.65	.68	.30	1.08	.39	4.20
Apr. 1, 1937-June 30, 1937	5.86	.60	.15	1.37	.53	3.21
July 1, 1937-Sept.21, 1937	6.63	.66	.10	1.44	.43	4.00

COMMENTS ON TABLE 23

Over-running the stop line shows the heaviest violations. This together with starting ahead of the light, are the two types of violations made by cars that stop. While these two violations show an average of 4½% for the three years, these violations rarely result in accidents, thus being more of a nuisance to pedestrians than an actual danger.

The 2% of cars that violate the lights are much more of a menace. These cars are all in motion, often at high speed, and particularly when they go thru the red and amber lights (the pedestrian period) they are likely to kill or injure.

Over-running the stop line is often due to the fact that these lines are not prominent or distinct, and a motorist does not watch the stop sign on the side of the road as he is intent on watching the traffic signal.

Getting caught on the red light could be lessened by the installation of a secondary amber light, synchronized with the main traffic amber light, appropriately placed before the intersection, allowing the average speed car to be warned in time to stop before the lights changed.

Table 24

PEDESTRIAN SIGNAL VIOLATIONS

SEASONAL COMPARISON

BY QUARTERS
Oct. 1, 1934 to Sept. 21, 1937

NUMBERED ROUTES
MASSACHUSETTS

QUARTER PERIOD COVERED	TOTAL VOLUME	TOTAL VIOLATIONS	PERCENT VIOLATIONS
Oct. 1, 1934-Dec. 20, 1934	7,605	3,021	39.7
Dec. 21, 1934-Mar. 21, 1935	13,571	7,523	55.4
Mar. 22, 1935-June 21, 1935	32,628	13,792	42.2
June 22, 1935-Sept.21, 1935	37,154	17,816	47.5
Sept.22, 1935-Dec. 21, 1935	95,974	44,483	46.3
Dec. 22, 1935-Mar. 21, 1936	81,864	43,142	52.7
Mar. 22, 1936-June 21, 1936	92,699	40,972	44.2
June 22, 1936-Sept.22, 1936	69,588	30,410	43.7
Sept.23, 1936-Dec. 31, 1936	93,401	38,108	40.8
Jan. 2, 1937-Mar. 31, 1937	42,631	18,630	43.7
Apr. 1, 1937-June 30, 1937	65,483	25,604	39.1
July 1, 1937-Sept.21, 1937	35,443	12,455	35.3
TOTALS	668,041	295,956	44.3

COMMENTS ON TABLE 24

Pedestrian violations are much greater than driver violations. At traffic lights the driver violation is about 2% against the lights compared with over 44% for the pedestrian over a 3 year period. The pedestrian record is improving as the average for 1935 shows 46.6%, 1936 shows 45.2%, and 1937 shows 39.5%.

It will be noted that pedestrians, like drivers, take more chances when the traffic is light, in other words, the peak of pedestrian violation is in the winter quarter as is the case with driver violations.

PEDESTRIAN SIGNAL VIOLATIONS

SEASONAL COMPARISON

By Quarters

Oct. 1, 1934 to Sept. 21, 1937

Massachusetts

Numbered Routes

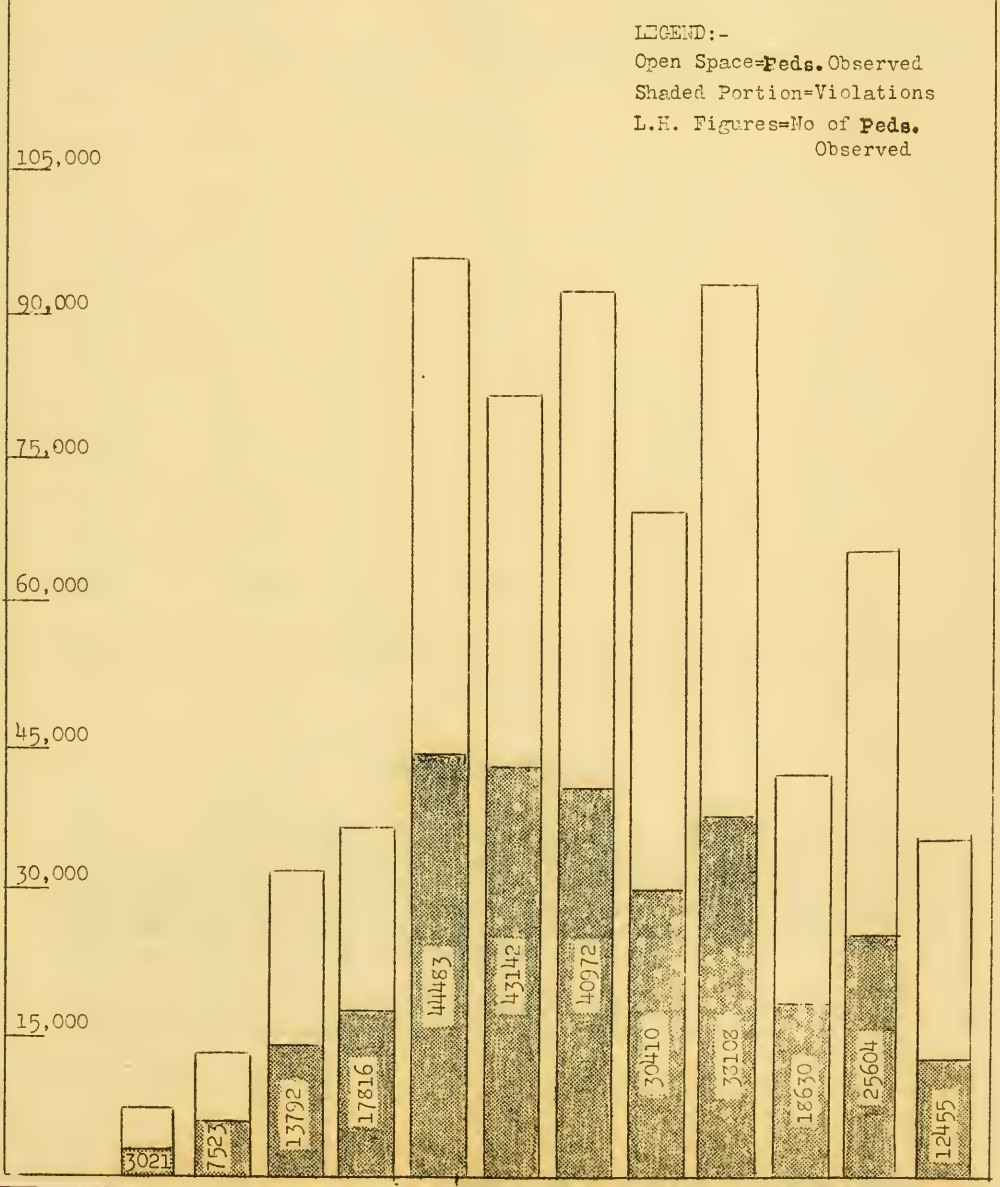


Table 25

STOP SIGN VIOLATIONS

SEASONAL COMPARISON

BY QUARTERS
OCT. 1, 1934 to SEPT. 21, 1937

NUMBERED ROUTES
MASSACHUSETTS

QUARTER PERIOD COVERED	TOTAL VOLUME	TOTAL VIOLATIONS	PERCENT OF VIOLATIONS
Oct. 1, 1934-Dec. 20, 1934	31,177	15,434	49.5
Dec. 21, 1934-Mar. 21, 1935	19,251	10,715	55.6
Mar. 22, 1935-June 21, 1935	37,190	18,717	50.2
June 22, 1935-Sept.21, 1935	62,376	22,538	36.1
Sept.22, 1935-Dec. 21, 1935	68,201	29,085	42.5
Dec. 22, 1935-Mar. 21, 1936	38,864	16,662	42.9
Mar. 22, 1936-June 21, 1936	61,867	24,437	39.5
June 22, 1936-Sept.21, 1936	49,140	17,690	36.0
Sept.23, 1936-Dec. 31, 1936	42,924	9,486	22.1
Jan. 2, 1937-Mar. 31, 1937	31,087	5,813	18.7
Apr. 1, 1937-June 30, 1937	44,992	9,313	20.7
July 1, 1937-Sept.21, 1937	30,445	4,216	13.85
TOTALS	517,514	184,106	35.6

COMMENTS ON TABLE 25

Prior to September 1936 we recorded all drivers as violators who did not stop at Stop Signs. After that date all drivers traveling under 3 mph. who did not stop at Stop Signs were not recorded as violators. This method automatically reduced the violation figures by about 20%. With this fact in mind it will be seen that no real improvement was noticable until the summer quarter of 1937.

A three year average shows that the greatest violations occur during the winter season when the traffic is lightest.

STOP SIGN VIOLATIONS

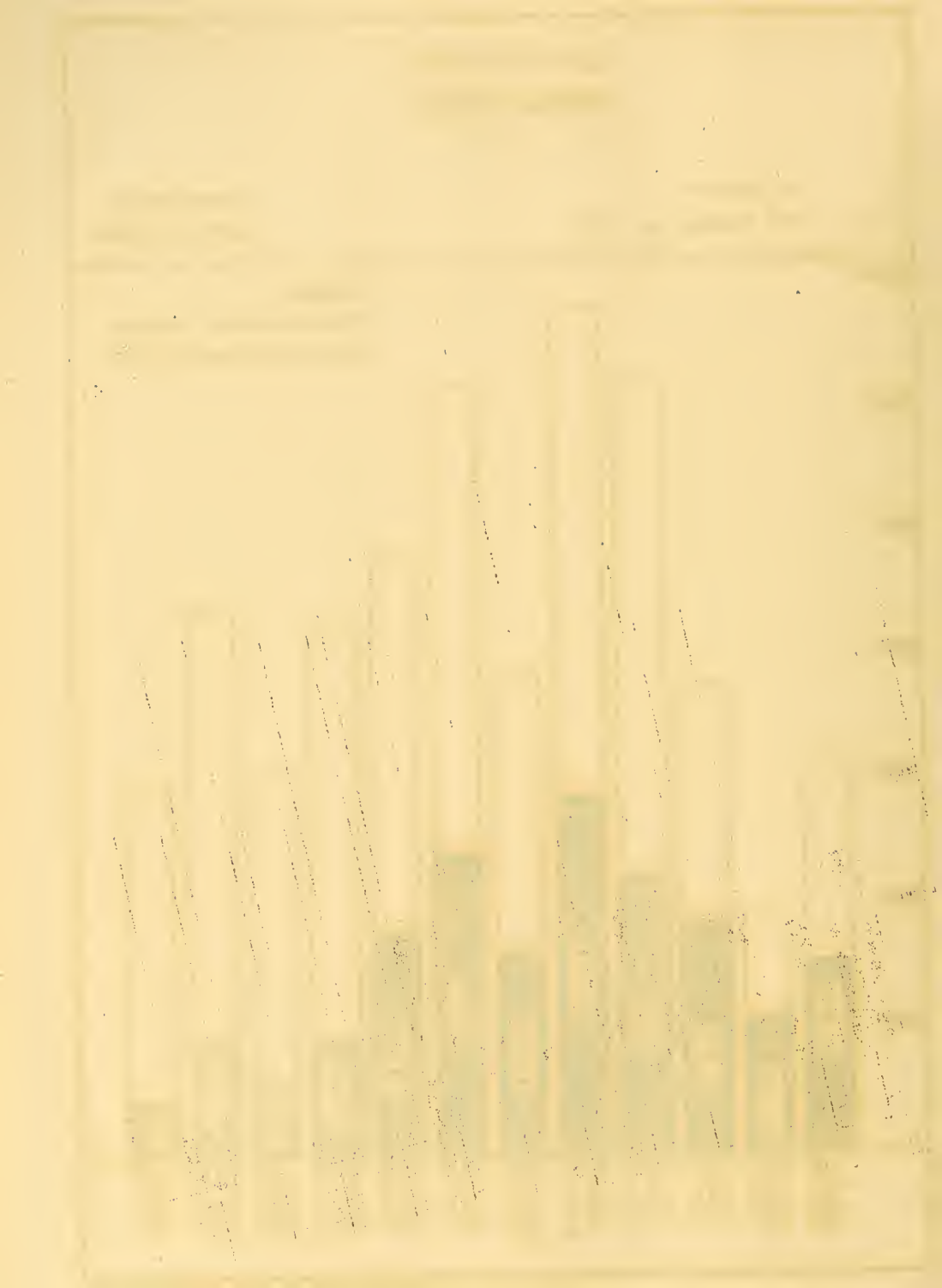
SEASONAL COMPARISON

By Quarters

Oct. 1, 1934 to Sept. 21, 1937

Massachusetts

Numbered routes



STOP-SIGN VIOLATIONS

BY TYPES OF INTERSECTION

BY QUARTERS
OCT. 1, 1934 to Sept. 21, 1937

NUMBERED ROUTES
MASSACHUSETTS

PERIOD COVERED	Y-TYPE	T-TYPE	X TYPE	ALL TYPES
Oct. 1, 1934-Dec. 20, 1934	46.9	50.3	51.5	49.5
Dec. 21, 1934-Mar. 21, 1935	52.2	60.2	56.9	56.6
Mar. 22, 1935-June 21, 1935	58.4	52.8	39.8	50.2
June 22, 1935-Sept.21, 1935	42.3	34.8	35.5	36.1
Sept.22, 1935-Dec. 21, 1935	49.7	34.7	43.0	42.5
Dec. 22, 1935-Mar. 21, 1936	37.6	44.9	44.3	42.9
Mar. 22, 1936-June 21, 1936	39.4	47.6	36.8	39.1
June 22, 1936-Sept.21, 1936	39.98	33.85	34.61	35.99
Sept.22, 1936-Dec. 31, 1936	43.78	23.05	14.44	21.99
Jan. 1, 1937-Mar. 31, 1937	27.3	17.0	16.7	18.7
Apr. 1, 1937-June 30, 1937	27.1	33.1	16.1	20.7
July 1, 1937-Sept.21, 1937	21.8	15.4	11.6	13.8

COMMENTS ON TABLE 26

This table shows that one law at least is observed; the first law of nature-self-preservation.

Why does the cross type of intersection show highest percentage of violation in only one quarter, with the T type showing in 4 quarters and the Y type showing in 7 quarters?

The answer is that the motorist knows that in the cross type of intersection he can be hit by cross traffic coming in 3 or more directions, in T type he can be hit from only 2 directions, while in a Y type he can be hit from only one direction.

The drop in percentages in the last four quarters is explained in the previous table.

VIOLATIONS
BY TYPE OF ROAD
(NUMBER OF LANES)
RECORD FROM JULY 1 TO SEPT. 21, 1937
ON NUMBERED ROUTES IN MASS.

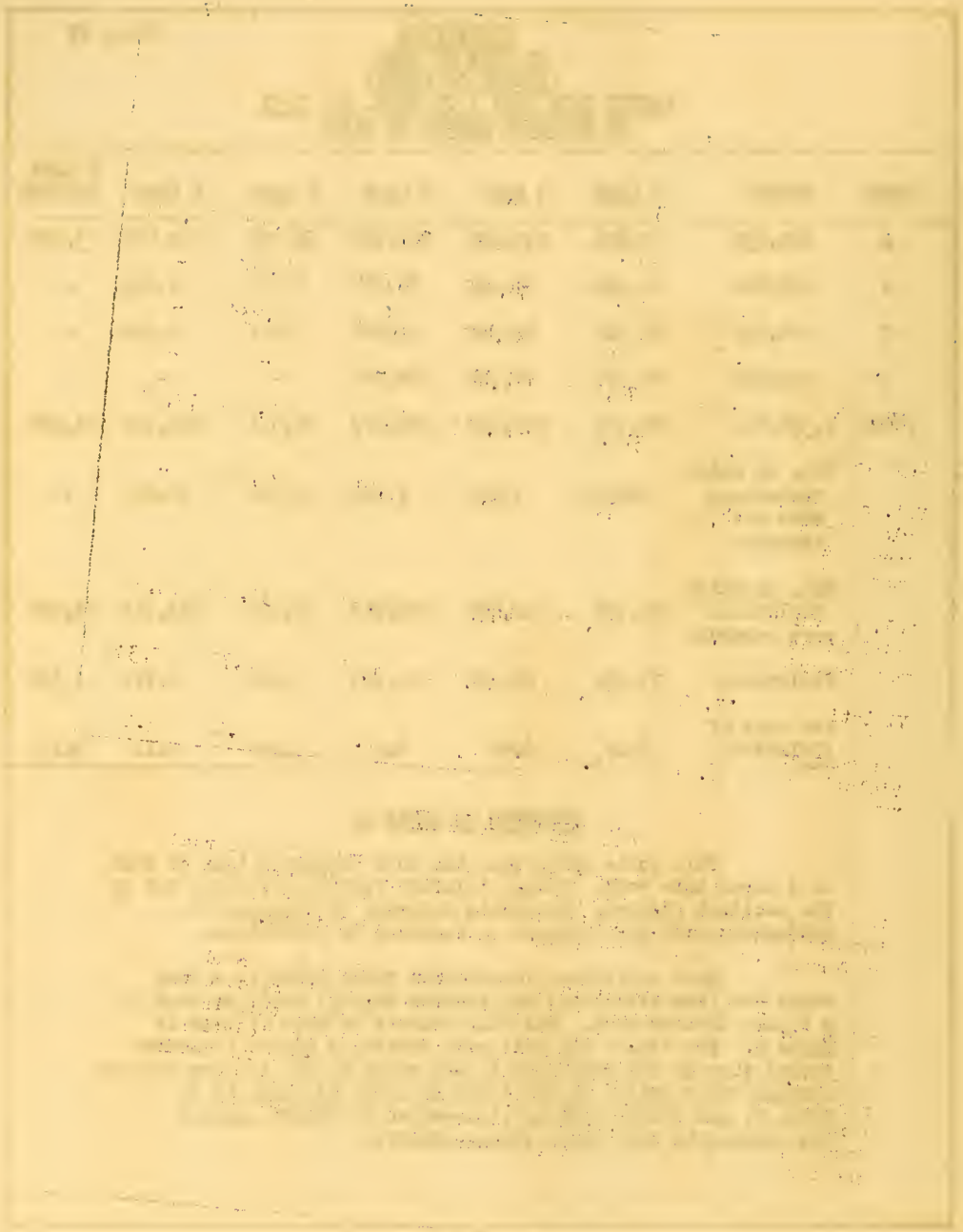
Table 27

TROOP	VOLUME	2 LANE	3 LANE	4 LANE	5 LANE	6 LANE	6 LANE DIVIDED
A	685,638	67,656	139,693	267,163	28,736	108,406	73,984
B	279,542	63,909	54,053	34,765	8,769	14,569	-
C	154,039	52,915	43,958	39,441	9,487	8,238	-
D	235,223	46,057	74,722	114,444	-	-	-
TOTAL	1,354,442	284,997	319,428	459,017	64,911	152,105	73,984
	Vol. on which violations were not recorded	54,460	7,002	3,204	17,919	20,892	-
	Vol. on which violations were recorded	230,537	312,426	455,813	46,992	131,213	73,984
	Violations	13,938	20,507	19,123	1,041	2,772	2,330
	Per cent of Violations	6.07	6.56	4.2	2.22	2.11	3.15

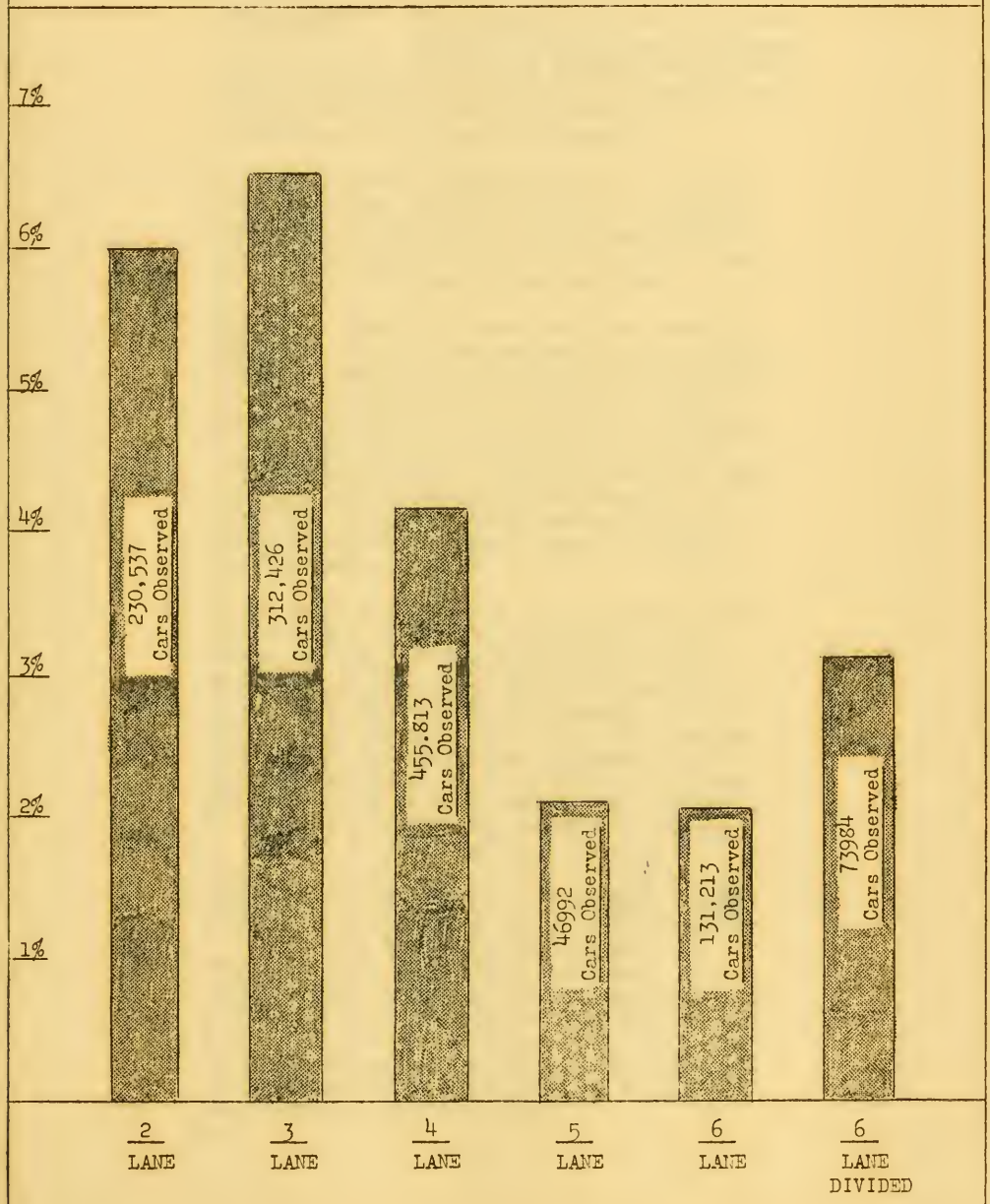
COMMENTS ON TABLE 27

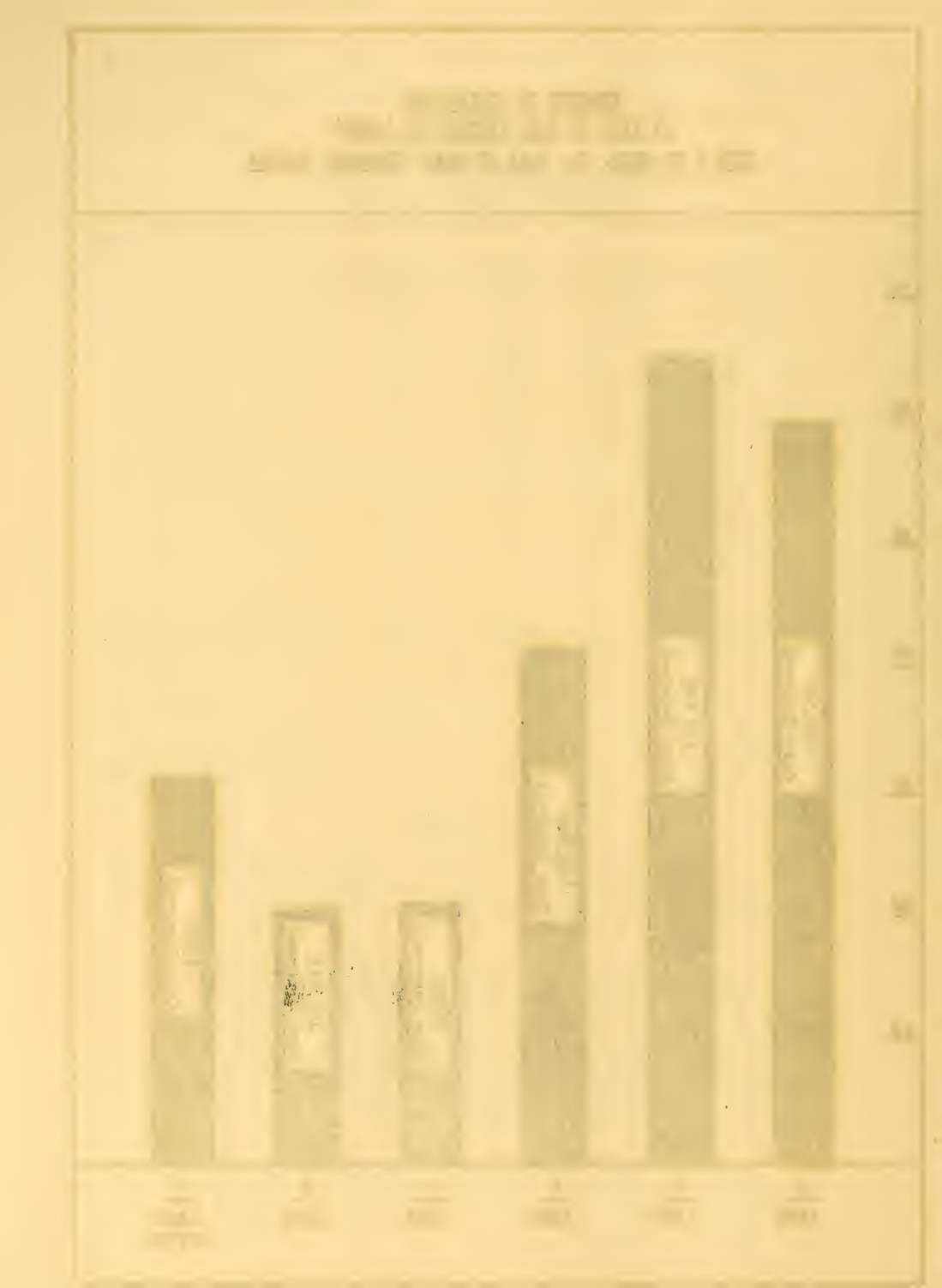
This table shows that the most dangerous type of road is a three lane road. These violation figures are borne out by the accident figures. Accidents increase or decrease in conformity with the increase or decrease in violations.

Each additional lane beyond three added to a road makes for less violations and greater safety, until we come to a 6 lane divided road. The only example we have of this is Route 9. The reason for this road showing a higher violation record than do the undivided 6 lane roads is due to cars turning through the openings in the dividing strip of land, on to Route 9, and either getting side-swiped or pushed against the curbing by high speed through-traffic.



PERCENT OF VIOLATIONS
BY TYPE OF ROAD (NUMBER OF LANES)
JULY 1 TO SEPT. 21, 1937 ON MASS. NUMBERED ROUTES





(d) Speed - Much has been said on this subject and there is much more to be said. While speed is in itself not always dangerous, speed too fast for conditions is.

Average Speed - The average speed for this State is 38.2 miles per hour, as shown by our studies. This is an average derived from speed tests made on all types of highways, under all weather conditions, and under all road conditions, in all types of districts.

We have observed 1,369,705 cars for speed and have found that 37.5% of these cars traveled over 40 miles per hour. One car was clocked at 112.6 miles per hour and two or three others were doing 100 miles per hour and over.

What is Excessive Speed - There are times and places when 45 or 50 miles per hour is not excessive speed. If physical conditions are good, a car is in good condition, likewise the driver, it may not prove dangerous. On the other hand 8 or 10 miles per hour at some locations may be classed as excessive speed (too fast for conditions); for example - in a thickly settled district where vision is partially obscured, pedestrian and vehicular traffic heavy.

In the year of 1937 speed was responsible for 1/5, or 20% of the total accidents in the State. The greater the speed, the worse the accident. In the United States during 1937, of all accidents resulting in deaths or injuries, so far as is known from the description of such accidents, one accident out of sixty-one was fatal at 20 to 29 miles per hour; one accident in thirty-five was fatal at 30 to 39 miles per hour; one accident in eleven is fatal at 50 miles and over per hour.

Influence of Lanes - We find from our observations that as the number of lanes are increased the average speed increases. A four lane road, the outside lanes being of cement and the inner two lanes of macadam, with a center line, is perhaps the best type of road. The average driver will stay in the cement (or outer) lanes, hesitate to cut into the macadam thereby eliminating the hazards of "failed to keep right" (or hogging the road).

VI HAZARDOUS LOCATION STUDIES

1 ORIGIN OF PROBLEM

Soon after the work of this project had begun, and our men appeared on the highways, a certain amount of curiosity was aroused as to their purpose. The local police were particularly curious because it became their duty to ascertain why our cars were parked for considerable periods beside the roads. This curiosity was further increased by the appearance of our men at local police headquarters to record motor vehicle accidents. Later still it spread to citizens and our appearance at public gatherings, to speak on highway safety, indicated our purpose to many not previously aware of our existence.

Within a very short time these contacts brought requests for a great variety of information concerning traffic in different parts of the State and for studies of locations known to be bad, or of an accident-prone nature. There was always evident in these requests the same uncertainty as to where responsibility actually lay. It appeared to be a question as to the manner for determining whether any action looking to the removal of dangerous locations should be done under State or Local authority. If under State authority there arose the question as to what approach, or application, was required and to what particular division.

Usually there was a frank admission of a lack of such definite information. This was particularly true in those smaller cities and towns where not enough traffic problems appeared to occupy the full time of a traffic engineer or officer. Here were found the most frequent pleaders for assistance. It was natural, therefore, for these various town selectmen, police officials and private citizens, who were interested in reducing automobile accidents, to ask for traffic studies at locations which they considered as immediate, or even future, accident spots and which they proposed to correct.

2 APPROACH TO PROBLEM

After the project had been in existence for over a year these applications for aid revealed their growing importance and made it necessary to have a clearing house for covering this Hazardous Location work, to insure its proper and complete preparation, as well as its follow-up to some definite disposition through the permitted channels.

Not only the town officials and citizens brought these Hazardous Locations to light but each Field Crew, including the Mobile Crew, were instructed to consider it one of their principal duties to report such locations as were encountered on the highways during the course of their travels, or at sites to which they had been assigned for routine work.

Accident records, as well as motor traffic violation records, in the course of normal office examinations, constantly brought Hazardous Locations to attention. These examinations often revealed locations which checked with those already called to attention from one or more of the sources mentioned above.

Our field crews, acting under these instructions, have selected and reported many such Hazardous Locations.

3 LOCATIONS INDICATED BY LOCAL POLICE AND TOWN OFFICIALS

In picking up accident records from the local police our men were continually questioned concerning "bad spots" and with requests for suggestions for remedying such locations. Approximately four hundred and fifty locations in the State were suggested by local police alone as places which, in their estimation, needed special attention. The major portion of these locations were at sites where motor traffic violation studies had already been made by our Field Crews and where accident record had not improved. Although the accident record was not heavy, special hazards existed which demanded rectification of one sort or another to eliminate the possibility of future accidents.

The locations named by the local police, if their accident record warranted, were referred to our troop supervisors for examination and for their recommendation as to whether or not a study should be made. It was found that out of this group of four hundred and fifty locations, two hundred and forty were advised by the supervisors for intensive and special study. The accident record of the balance is kept under scrutiny pending the time these, too, become more hazardous.

VII MOBILE SPEED STUDIES

This division covers the work carried on by the Mobile Speed Department of the Highway Traffic Research over a period of twenty-six months from October 1934 to December 1936 inclusive.

This report constitutes a research study of the speed characteristics taken at high-speed locations on all the important state highways of Massachusetts east of the Connecticut River.

Observations were taken during every part of the year and covered all conditions of road surface due to changes in weather and seasons of the year. Representative studies were taken also on every day of the week and during every hour of the day and night except the lightly traveled hours in the early morning from 2:00AM to 7:00AM.

The field personnel comprised two crews of two men each during the whole period, and for a period of about ten months an additional crew was added. Each crew was provided with the following equipment:

One Electric Speed Meter with flexible cable to connect to trips.

Two steel trips with tie wires and spikes to fasten trips to roadway.

One tape measure.

One storage battery.

Field data sheets and lap boards equipped with small shaded light for night recording.

The Electric Speed Meters used in this work were designed and constructed by members of the Highway Traffic Research in the laboratories of the Massachusetts Institute of Technology. One man is required to operate the speed meter; the other man of the crew records the speeds as they are called out by the observer. A relief man is sometimes provided for long observation periods, for the relief of either man of the crew when the traffic is heavy and continuous.

Locations of Field Studies
Electric Speed Meter
from
October to 1936 to January 1 1937
Highway Traffic Research

DESCRIPTION OF APPARATUS:

Plate 2A shows one end of a road trip with the tape removed. It consists of two strips of spring steel 40" long and 1/32" in thickness. The bottom steel is 1" in width and the top steel is 7/8" in width. Pieces of rubber tubing 3/4" in length are strung along the top steel about 1-1/2" apart. The lead wires going to the speed meter are soldered to one end of each steel strip. The two steel strips are taped together, first with rubber tape and then with friction tape. The tie wires which are used to fasten the trips to the road are attached to the bottom steel.

When the trip is stretched across the road in ite normal position at right angles to the flow of traffic to be observed, the two steel strips are separated by the thickness of the rubber tubing. As a car passes over each trip the top steel is pressed down making contact with the bottom steel, allowing current to pass through the lead wires which, in turn, is registered in the speed meter. In setting up the apparatus for road test, care must be exercised to keep the two steel strips from contacting at any point through buckling, or any other cause which would result in a short circuit in its normal position.

Water getting in between the two steels will also cause a short circuit. Therefore, during the first part of the survey an overshoe was used on wet roads. This consisted of a thick rubber tube drawn over the entire trip which, while it eliminated the water, made the trip very cumbersome and sometimes attracted the notice of the driver of a car whose speed was being measured. Later a "wet short" eliminator was developed by engineers on this project, which when placed in the series with the trips and speed meter, overcame the difficulty due to wet trips in stormy weather.

This "wet short" eliminator consists of two vacuum tubes arranged in a circuit with suitable resistances and small dry cells, all enclosed in a small box which measures 6" x 8" x 10". This unit offers enough resistance in the circuit to offset the effect of a "water short" but at the same time allows normal operation of the meter when a car passes over the trips.

ELECTRIC SPEED DETECTOR

ROAD TRIP DETAIL

HIGHWAY TRAFFIC RESEARCH
MASS DEPT. PUBLIC SAFETY
COMMONWEALTH PIER BOSTON MASS

Note - The portion of trip above is uncovered to show assembly. All is covered with rubber tape and insulating compound when in use.

Plates 3A and 3B show outside and inside views of the speed meter respectively. From Plate 3A it will be observed in the lower left-hand corner there are three terminal posts to which the lead wires from the trips are attached. At the bottom center there are four keys. The extreme left-hand key is used to shut the set off or cut it on. Moving to the right, the next is the test key and the third one is the direction key. The fourth key is the reset key. The knobs in the middle of the panel are potentiometers used to adjust the current and voltage in the set. The upper left-hand clock is a 5-milliammeter which has been calibrated directly in miles per hour. This is the clock which registers the car speeds. The other clocks to the right are used to adjust the current and voltage in the set to their correct values.

METHOD OF OPERATION OF THE SPEED METER:

The two steel trips are stretched across the highway exactly at right angles to the direction of travel and fastened there securely at each end. The distance between the trips is governed by the speed meter that is used, each meter requiring a certain definite spacing of the trips which cannot be changed unless the meter is recalibrated. Speed meter D-3 shown on page 57 was calibrated at 16' for the space between trips. This spacing was found to give very satisfactory operation. A lead wire connects the near end of each trip to the speed meter which is generally placed in an automobile parked off the roadway. All the work of observing and recording the data is thus carried on in the parked car. In this way the driver of a car under observation does not know that his speed is being measured and therefore a true picture of the actual speed is obtained.

The speed indicator of the meter is graduated directly in miles per hour from 100 to 10. As the front tires of a car to be observed hit the nearest trip, current flows from the storage battery into an electric condenser. The needle of the speed indicator, which is a milliampere meter with its scale set to read in miles per hour, starts to move from 100 M.P.H. toward 10 M.P.H. The instant the same front tires hit the second trip this flow of current ceases and the needle stops automatically at the speed at which the car is going. The speed is observed and recorded and the meter is then quickly reset by the snap of a key, discharging the condenser, and almost instantly made ready for the next car in line. Cars going in the opposite direction are clocked in like manner by simply throwing a direction key which allows the current to start flowing in whichever trip is nearest the approaching car.

This meter is capable of handling traffic of heavy volume. Since total volume up to 1,000 cars per half hour have been clocked this method of speed recording automatically includes a volume count.

ELECTRIC SPEED DETECTOR
NO D-3
OPERATING PANEL

ELECTRIC SPEED DETECTOR
NO 3-D
INTERIOR

The effectiveness of this method of measuring speed depends on the accuracy of its speed meter and of the observer, and upon the correctness of operation. As this speed meter is extremely simple to operate very little practice is necessary to secure correct observations. The speed meter itself was checked against speedometers which were known to be correct.

GENERAL COMMENTS:

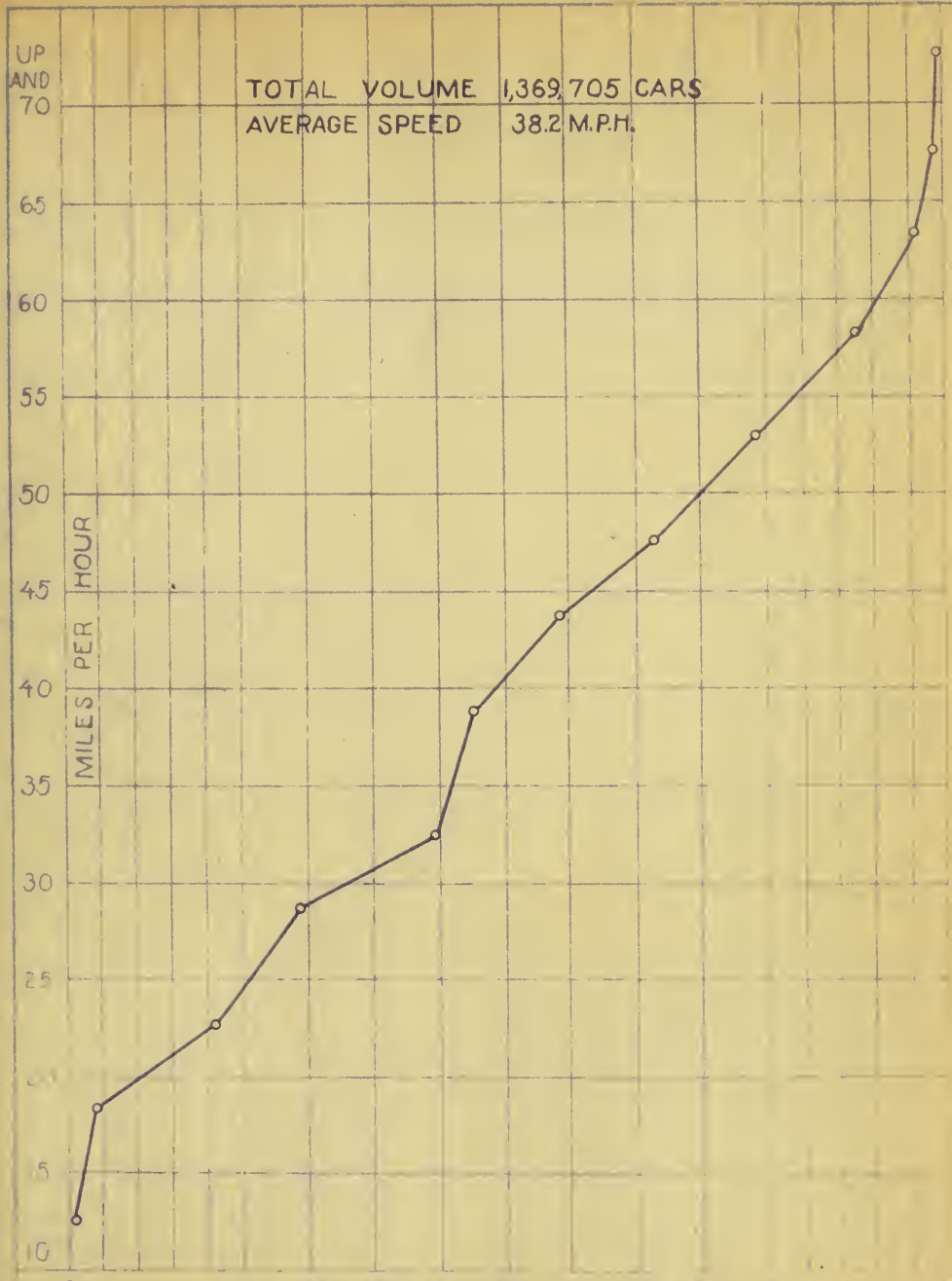
A total of 923 studies were made at 684 locations. The 1,369,705 cars and trucks observed showed an average speed of 38.2 M.P.H. The total number of cars observed during the daylight hours was 1,018,743 and showed an average speed of 38.2 M.P.H. The total number of cars observed during the night hours was 350,962 with an average speed of 38.0 M.P.H. The night period was considered as beginning at one-half hour after sunset. Maximum speeds were observed as high as 100 M.P.H. at night in Norwood on route 1 in October 1934.

Table 1(Appendix) is a general summary covering the entire survey. Observations have been classified as to night and day and also night and day combined. Under each of these classifications detailed information for each route has been recorded. This includes cars clocked (which is essentially the same as total traffic, since over the entire survey approximately 98.0% of the total traffic was clocked), also average speeds. Total studies and locations also are shown for each route under combined night and day.

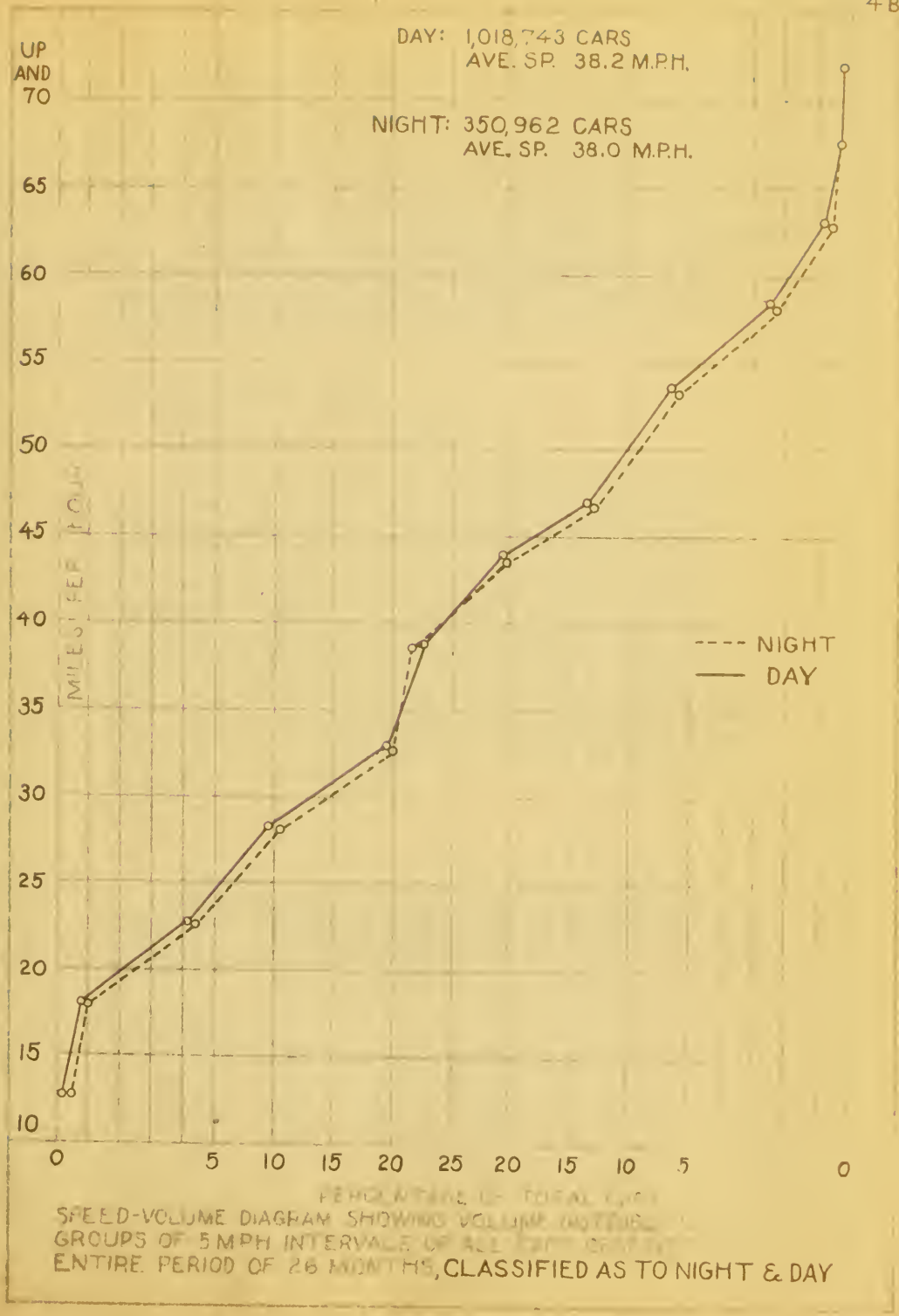
It will be observed that on 36 routes figures are given for night and day. Twenty-three of these routes show faster speeds for the day while eleven show faster speeds for the night, with two showing equal speeds for day and night. These figures show that in comparing night and day speeds other factors must be considered besides the actual condition of daylight or darkness.

An important factor is the topography of the road. A route that has frequent curves, intersections and hillcrests would certainly show a lower speed at night. The character of travel on a route that is fairly straight and level could make for a higher speed at night such, for example, a thru route where the volume was much less at night than during the day.

Route 114 shows a speed of 9.4 M.P.H. lower for day than night. This is due to a day study taken in Lawrence at an intersection which gave a large volume and a low average speed. If this study were left out of the day figures the average speeds for day and night would be very nearly the same.



SPEED-VOLUME DIAGRAM SHOWING VOLUME DISTRIBUTION IN SPEED GROUPS OF 5 M.P.H. INTERVALS OF ALL CARS OBSERVED OVER THE ENTIRE PERIOD OF 24 MONTHS



SPEED-VOLUME DIAGRAM SHOWING VOLUME NOT IN GROUPS OF 5 MPH INTERVALS OF ALL CARS OBSERVED ENTIRE PERIOD OF 26 MONTHS, CLASSIFIED AS TO NIGHT & DAY

Table 1A (Appendix) is a general summary covering all of the day observations, showing speed volume distribution in 5 miles per hour groups for each route. Table 1B (Appendix) is the same as 1A(Appendix) but covering night observations. Tables 2 and 3 (Appendix) show comparative speeds on the same routes when dry and when wet. Table 4 (Appendix) is a study of icy roads. Table 5 (Appendix) is a speed-volume study. Tables 6, 7 and 8 (Appendix) show studies of straightaways, curves, hillcrests and intersections according to the number of lanes. Table 9 (Appendix) shows a volume-speed range analysis on certain key routes. Table 10 (Appendix) shows comparative speeds classified according to location, that is, rural, suburban, or urban.

FACTORS INFLUENCING SPEED:

Effect of Changes in Weather.

In making this study only straightaways were considered and the same, or similar, locations were taken under each condition. From Tables 2, 3 and 4 of the Appendix it will be seen that the fastest speeds were observed under fair weather and dry road surface conditions, and lowest speeds under icy road surface conditions. For the wet condition the speed is lowered, due to the actual presence of rain in the atmosphere making for poor visibility, rather than the wet surface of the road itself, because other studies were taken on wet roads when the weather was fair or cloudy and it was found that the speed was as high as when the roadway was dry. This is clearly indicated by the following table where observations were made at different types of hazards. It will be observed in some cases that the road when wet shows even a higher speed than when dry.

Study Showing Average Speeds on Wet vs Dry Roads Without Precipitation-Taken at Identical Locations

Nature of Hazard	Number of Cars	Ave. Speed MPH Wet Rd.	Dry Rd.	Type of Surface	Number of Lanes
Straightaway and Dip	5601	47.0	47.8	Concrete	4
Straightaway and Dip	1692	37.3	34.3	Concrete	2
Intersection	1592	35.1	35.0	R. Macadam	2
Straightaway	4175	35.2	35.7	Concrete	2
"	1258	39.8	38.6	R. Macadam	3
Curve and Hillcrest	1043	29.3	29.1	Macadam	3
Straightaway and Dip	2328	35.6	38.9	R. Macadam	3
	17694	37.1	37.0		

Effect of Changes in Weather (Con't)

In the following table is presented results obtained by making observations under fair weather and dry road conditions and again at the same locations when the surface was icy:

Study Showing Average Speeds On Icy vs Dry Roads
Taken at Identical Locations

Type of Hazard	Number Of Cars	Average Speed M.P.H. Icy Rd.	Dry Rd.	Type of Surface	Number Of Lanes
Hillcrest	7512	27.6	36.0	Concrete	4
Intersection	2642	27.8	38.3	Concrete	3
	10154	27.7	37.2		

Effect of Volume on Car Speeds.

Table 5 (Appendix) shows a speed study taken on route 28, south of Boston, at four different locations in Middleboro between the hours of 4:00P.M. and 10:00 P.M. each study being two and one-half hours long. In order to get the results of a difference in volume the same locations were used on Sunday as on Monday.

The greatly increased volume of 12,457 cars on Sunday lowered the average speed 7.5 M.P.H. as compared with Monday when the volume was 1613 cars. Both of these days had favorable weather conditions so that the major factor causing the variation in speed must have been the difference in volume. The difference in the character of travel between the two days would not be such as to cause anything like the difference in speeds at the points observed because route 28, south of Boston, is a thru route to Cape Cod with very little slow traffic at the locations studied.

Somewhere between the low volume and the high volume is a saturation point where any further increase in volume causes a corresponding decrease in speed. Until this saturation point is reached variation in volume has no appreciable effect on speed. This was shown by studies taken under similar conditions at the same location where there was a variation in volume, the higher volume actually giving a higher speed.

In order to make a further study of the effect of volume on car speeds additional observations were made in Middleboro on route 28 not far from where the observations were made the year before. This time observations were made over a much longer period with the expectation that more definite results could be obtained.

Effect of Volume on Car Speeds

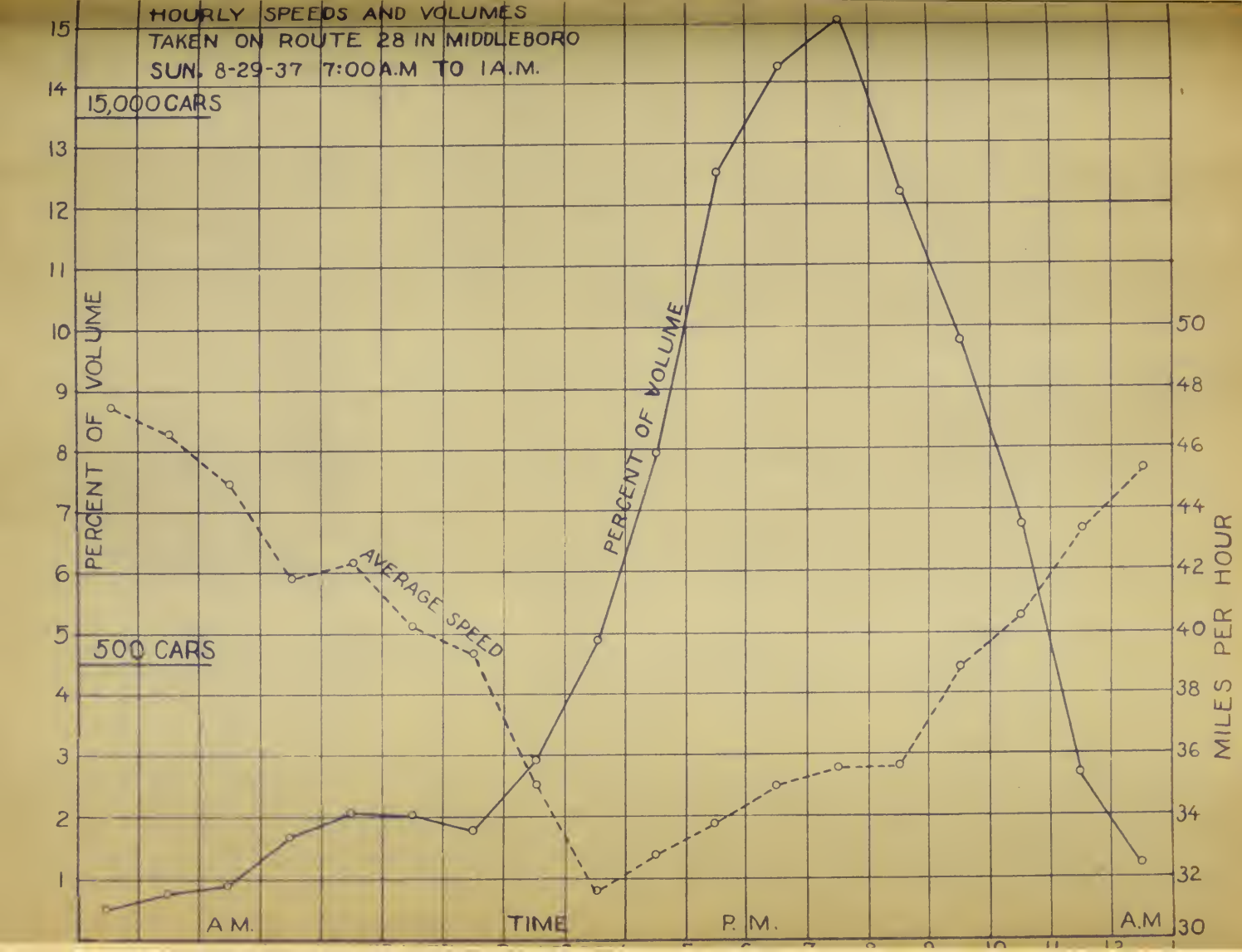
On page 96 is a diagram of a study showing the variation in hourly speeds and volumes taken on route 28 in Middleboro, Sunday, August 29, 1937. Observations were taken over a period of eighteen hours from 7:00 A.M. Sunday to 1:00 A.M. Monday.

Starting at 7:00 A.M. there is a material decrease in speed until mid-afternoon is reached. This decrease in speed is caused wholly by the character of driving as there is only a small increase in volume in this period. The minimum average speed is reached between three and four o'clock. This is probably due to the usual slow class of drivers who are out on Sunday afternoon. The speed remains fairly constant from six to eight o'clock and the volume is at its peak during these two hours. It is quite probable that the speed would have shown a decided increase beginning at six o'clock had it not been for this heavy volume, because between eight and nine o'clock when the volume starts to decrease sharply the speed starts to increase sharply. Normally we would not expect an increase of speed after eight o'clock because of darkness, but rather a slight decrease.

Between 8:00 P.M. and 9:00 P.M. the average speed was 35.6 M.P.H. while between 12:00 midnight and 1:00 A.M. it jumped to 45.6 M.P.H. a difference of 10 M.P.H. It would seem to be a fair assumption that the major factor in causing this 10 M.P.H. increase in speed was the large decrease in volume over this period.

A similar study was made at this same location in Middleboro on Saturday, August 28, 1937. The diagram is shown on page 99. Here the volume was not heavy enough at any time to have any material effect on the speed. It will be noticed that there is a gradual decrease in the average speed from early morning throughout the day and night, showing no relation to any increase or decrease in volume.

Comparing the average speeds from 8:00 P.M. to 1:00 A.M. on Saturday night to the same time on Sunday night we notice a marked difference. On Saturday night the speed remained fairly constant while on Sunday night there was an increase of 10 M.P.H. The reason for this must be the large decrease in volume on Sunday and the small decrease on Saturday.


HOURLY SPEEDS AND VOLUMES
TAKEN ON ROUTE 28 IN MIDDLEBORO
SUN. 8-29-37 7:00 A.M TO 1 A.M.
15,000 CARS
500 CARS
PERCENT OF VOLUME
AVERAGE SPEED
PERCENT OF VOLUME
MILES PER HOUR
A M.
TIME
P. M.
A.M
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
50
48
46
44
42
40
38
36
34
32
30

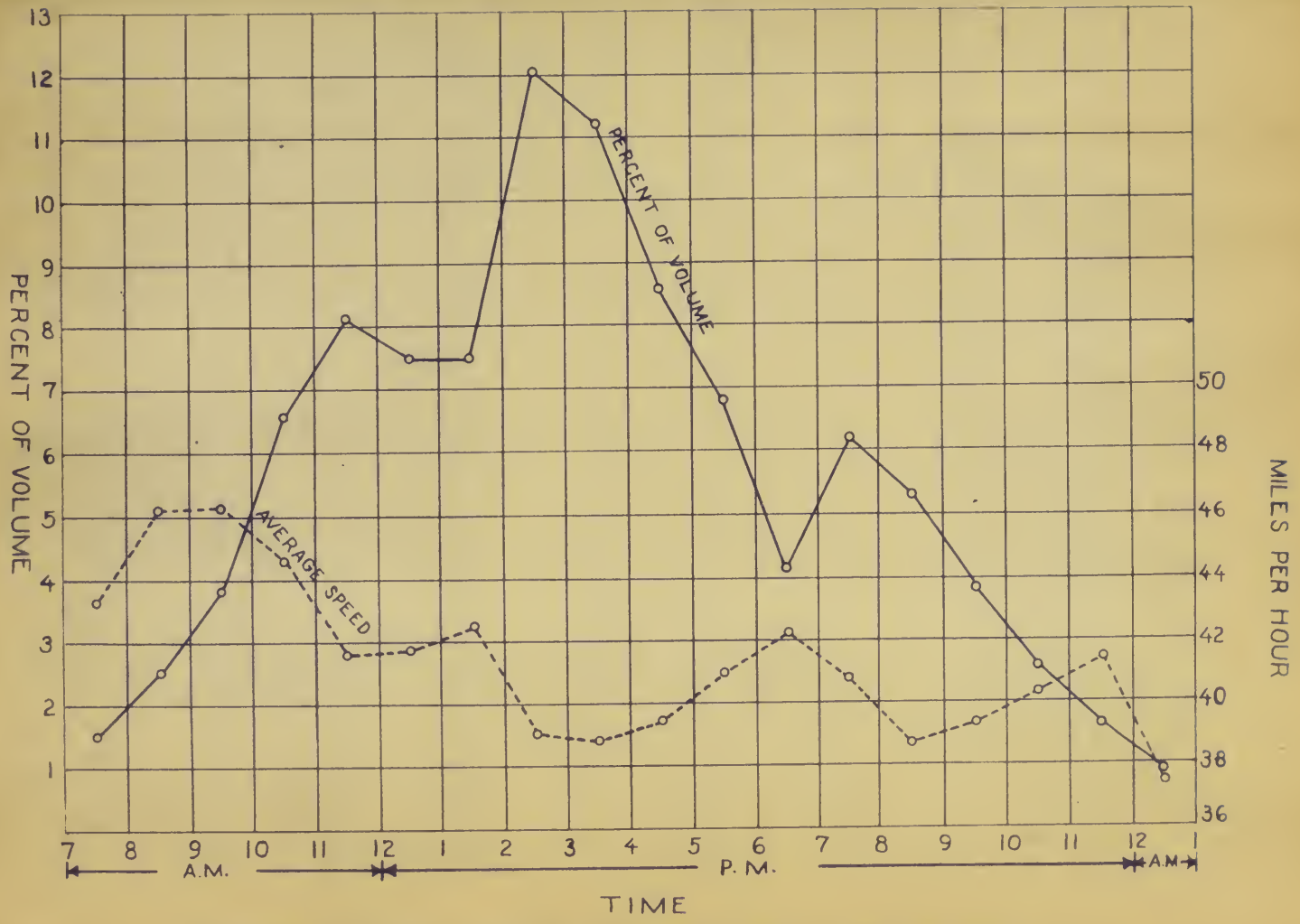


DIAGRAM SHOWING VARIATION IN HOURLY SPEEDS AND VOLUMES
TAKEN ON ROUTE 28 IN MIDDLEBORO SAT. 8-28-37 7:00A.M TO 1:00A.M.

On pages 101 and 102 are presented summaries of a six hour study taken in Hingham at an approach to an intersection. This is an example of the high volume which may be clocked by the electric speed meter. It is interesting to notice also the small variation in average speed from hour to hour although there is a large variation in volume. For instance, from 3:00 P.M. to 3:30 P.M. the volume was 692 cars in the east bound direction, with an average speed of 36.4 M.P.H. while from 4:00 P.M. to 4:30 P.M. the volume was only 294 cars, but the average speed still remained at 36.4 M.P.H. showing that this road is capable of taking care of far heavier volumes than any that were clocked.

526A

SPEED RANGE SUMMARY

ECHO

LOCATION 1.4 Mi. E. of Weymouth Line
ROUTE 3A HAZARD App. to Int. WEATHER Clear
PAVEMENT TYPE Mac CONDITION Dry LANES 4

CODE D 1199
TOWN Hingham
DATE 7-8-36 DAY Wed.
TIME 1 PM TO 7 PM

Number of Cars in Half Hourly Time Periods West Bound

SPEED RANGE M.P.H.	1:00 1:30	1:30 2:00	2:00 2:30	2:30 3:00	3:00 3:30	3:30 4:00	4:00 4:30	4:30 5:00	5:00 5:30	5:30 6:00	6:00 6:30	6:30 7:00	Sub Total Cl'kd	% Total Cl'kd	Accumulative %
Under 10															
10 to 14.9															
15 to 19.9	2			1	2								5	.2	.2
20 to 24.9	1	1	1			3	2	4	16				28	1.1	1.3
25 to 29.9	14		11	18	19	7	22	21	9				121	4.9	6.2
30 to 34.9	39	47	50	56	64	69	94	108	92				619	25.1	31.3
35 to 39.9	40	55	34	107	116	90	158	197	179				976	39.5	70.8
40 to 44.9	31	61	22	37	54	33	60	88	128				514	20.8	91.6
45 to 49.9	11	25	6	3	15	9	29	30	61				189	7.7	99.3
50 to 54.9	2	1			6		2	2	4				17	.7	100.
55 to 59.9															
60 to 64.9															
65 to 69.9															
70 to 74.9															
75 to 79.9															
80 or more															
Cars Clocked	140	190	124	222	276	211	367	450	489				2469		
Total Traffic	140	190	124	222	276	211	367	450	489				2469		
% " Clocked	100	100	100	100	100	100	100	100	100				100		
Car Miles	5086	7341	4372	7942	10052	7539	13457	16589	18621				90997		
Average Speed	363	38.6	35.3	35.8	36.4	35.7	36.7	36.9	38.8				36.9		
Maximum Speed	52	53	48	49	53	49	52	52	54				54		

VOLUME TOO LARGE TO GET BOTH DIRECTIONS

(101)

526A

SPEED RANGE SUMMARY

EHO

LOCATION 1.4 Mi. E. of Weymouth Line
ROUTE 3A HAZARD App. to Int. WEATHER Clear TRAP LENGTH 16 ft.
PAVEMENT TYPE Mac. CONDITION Dry LANES 4

CODE D 1199
TOWN Hingham
DATE 7-8-36 DAY Wed.
TIME 1 PM TO 7 PM

Number of Cars in Half Hourly Time Periods East Bound

SPEED RANGE M.P.H.	1:00 1:30	1:30 2:00	2:00 2:30	2:30 3:00	3:00 3:30	3:30 4:00	4:00 4:30	4:30 5:00	5:00 5:30	5:30 6:00	6:00 6:30	6:30 7:00	Sub Total Cl'kd	% Total Cl'kd	Accumulative %
Under 10															
10 to 14.9															
15 to 19.9															
20 to 24.9	9	1	1				1	2	2	2		2	20	.3	.3
25 to 29.9	34	3	11	62	65	7	10	20	8	3	6	10	239	4.2	4.5
30 to 34.9	168	166	105	235	228	109	92	123	143	108	103	163	1743	30.3	34.8
35 to 39.9	94	193	190	175	197	90	117	195	202	132	133	304	2072	36.0	70.8
40 to 44.9	32	75	72	144	167	37	62	106	109	163	174	128	1269	22.0	92.8
45 to 49.9	28	20	7	20	21	8	10	50	27	50	63	42	346	6.0	98.8
50 to 54.9		1	8	13	14		2	4	4	7	6	5	64	1.1	99.9
55 to 59.9				2						5			7	.1	100.
60 to 64.9															
65 to 69.9															
70 to 74.9															
75 to 79.9															
80 or more															
Cars Clocked	365	459	394	651	692	251	294	500	495	520	485	654	5760		
Total Traffic	365	459	394	651	692	251	294	500	495	520	485	654	5760		
% " Clocked	100	100	100	100	100	100	100	100	100	100	100	100	100		
Car Miles	12650	16624	14474	23296	25010	8895	10692	18764	18453	20088	17752	24407	211105		
Average Speed	34.7	36.2	36.7	35.8	36.1	35.4	36.4	37.5	37.3	38.6	36.6	37.3	36.7		
Maximum Speed	49	52	54	55	54	49	54	53	54	55	54	53	54		

(102)

Effect on Speed of Territory Traveled.

Table of comparative speeds, on straightaways only, on the three classes of highways throughout the state, under fair and dry conditions:

Group	Total Cars	50 M.P.H. and Up	40 M.P.H. and Up	Average Speed
Rural	19,454	4,866 25.0%	14,057 73.3%	44.0 MPH
Suburban	27,644	2,073 7.5%	14,098 50.9%	39.5 MPH
Urban	20,402	337 1.1%	5,646 27.7%	36.3 MPH

The above table shows the average speeds for the three classes of highways in this State on straightaways only, together with the number of cars going 50 M.P.H. and up, and 40 M.P.H. and up in each class. Data was taken from studies covering twenty-one different routes, thus giving a fair picture of speed conditions on straightaways throughout the State. It will be observed that rural straightaways show the highest speed with over 73% of the cars going 40 M.P.H. and up, while the urban shows the lowest with only 27.7% of the cars going 40 M.P.H. and up. Since no studies were taken in the cities of Boston, Worcester and Springfield the figures presented for the urban class were taken from observations made in the other large cities of the State such as Lowell, Salem and Fitchburg, where conditions at the location studied were similar to those in the larger cities. The largest variation comes in the 50 M.P.H. and up speed range which shows 25% of the cars in the rural group and only 1.1% in the urban group.

Effect of Type of Pavement on Car Speeds.

The following table shows a comparison of speeds on 3-lane concrete and 3-lane macadam roads. Only straightaways on the same route in each case were considered. Five different routes are presented. On four of the routes the speeds on concrete roads are faster, while on the other one macadam shows the higher speed. This would indicate that in the majority of cases concrete roads do show higher speeds than macadam roads, but that this may not be due entirely to the type of road surface but to some other factors such as the character of travel or the territory through which the road passes.

Table of Comparative Average Speeds on 3-Lane Cement Concrete and Tar-Bound Macadam Roads.

Route	Cement Concrete	Tar-Bound Macadam
1 North	44.7 M.P.H.	43.7 M.P.H.
138	37.5 "	39.8 "
20	46.0 "	43.7 "
125	45.8 "	39.6 "
12	42.9 "	42.4 "

Comparative Average Speeds at Different Hazards and With Varying Lane Widths.

The following table shows the variation in the average speed due to the different types of hazards and also due to a different number of lanes. Detailed figures are presented in the appendix on tables 6, 7 and 8. These figures are a composite of all studies made on all routes during the entire survey. The figures presented for straightaways show that as the number of lanes is increased the speed increases, except for the six-lane divided route, that is, route 9 from Brookline to Framingham. It alone must be taken as a criterion for all six-lane roads. The speed is comparatively lower on this route due to the fact that it passes through fairly thickly settled suburban areas with a great many intersections and traffic lights.

DAY

Hazards	2-Lanes	3-Lanes	4-Lanes	4-Lanes Divided	6-Lanes Divided
Straightaways	38.9	43.2	45.6	47.2	45.9
Curves	34.4	38.4	43.1		42.3
Intersections	36.7	38.4	35.2		

Hillcrests Only - All Lanes - Average Speed 38.7 M. P. H.
Hillcrests and Intersections " " 31.9 "

NIGHT

Hazards	2-Lanes	3-Lanes	4-Lanes	4-Lanes Divided	6-Lanes Divided
Straightaways	37.3	39.0	44.9	47.7	42.5
Curves	33.5	36.6	38.4		41.3
Intersections	35.4	35.2	33.7		

Hillcrests Only- All Lanes - Average Speed 37.8 M. P. H.
Hillcrests and Intersections " " 32.6 "

Comparative Average Speeds of Trucks and Passenger Cars.

A special six-hour study was made at three locations in Reading, North Reading and Andover on route 28 to determine the variation in speed between trucks and passenger cars. Cars and trucks were recorded separately as indicated in the following table. Light trucks under 1-1/2 tons carrying capacity were classed as passenger cars since their speed is approximately the same. It will be noted that while the average speed varied at the locations, although they are all straightaways on the same route, in every case the car speed is about six miles per hour faster than the truck speed.

Table of Comparative Average Speeds - Passenger Cars and Trucks - On Route 28 North of Boston - On Straightaways Only - Under Fair and Dry Conditions - 4-Lane Concrete and Macadam Roads.

Code	North Average Speed Cars	Trucks	South Average Speed Cars	Trucks
152	38.7 MPH	34.2 MPH	36.8 MPH	31.2 MPH
156	46.3 "	40.0 "	46.2 "	41.0 "
161	35.6 "	27.4 "	42.3 "	36.4 "
	40.2 "	33.9 "	41.8 "	36.2 "

Volume Speed Range Analysis on Key Routes.

The figures presented in Table 9 (Appendix) separate the total volume of traffic into four groups by speed ranges and are further classified as to night and day. The first group covers that part of the traffic going from 10 to 30 miles per hour and it will be observed that there is, in general, a larger percentage of volume in this range in the night than in the day.

The second group covers the intermediate or normal flow of traffic going from 30 to 50 miles per hour. About 75% of the total volume is in this range both in the night and in the day. It would seem that the ideal condition would be for all traffic to travel in this range because a great many accidents are caused by slow as well as by fast drivers; by fast drivers due directly to high speed, and by slow drivers slowing up traffic and causing cars behind to cut out of line in order to pass.

Referring again to Table 9 (Appendix) we find the third group covers the highest volume ten mile range. Here the maximum volume found within a given ten mile range is presented for each route. It will be observed that this classification provides a key to the character of the route because in most cases within this narrow ten mile range we

usually find about 45% of the total traffic for that route.

The fourth group covers the high speed traffic, that is, cars going 50 miles per hour and up. The diagram on page shows the percentage of total volume of traffic going 50 miles per hour and up for each route. The daylight traffic is arranged by routes with the highest percentage of volume at the left and lowest at the extreme right. Route 1, south of Boston, is the fastest route in the State with 25.4% of the total volume going 50 miles per hour and up for the day, and 19.6% for the night.

It will be noted that the night traffic curve does not always have the same trend as the day curve, especially on route 1, north of Boston, and route 9. This clearly indicates that while night speeds are generally lower than day speeds, the condition of darkness is not the only factor that causes this variation.

Night traffic on route 1, north of Boston, is much slower than the day traffic. This is due partly to the topography of the route where many steep grades and intersections are encountered, and partly to the large number of heavy interstate trucks which travel over this route at night, as this is a main line to Maine and parts of New Hampshire.

Route 9 is just the opposite of route 1, north of Boston, showing a large percentage of volume in the high speed class at night. This is due to the character of travel and probably to the fact that route 9 is fairly straight, unusually wide and level, and well lighted, making for relatively good visibility at night.

CORRELATION OF ACCIDENTS WITH SPEED:

On page [illegible] is a diagram showing the accident record compared with speeds on route 1, south of Boston, to Attleboro. Maximum speeds clocked at the different locations along the route are shown by a broken line. The average speed is indicated by a solid line, on which are shown the various hazards at the locations studied.

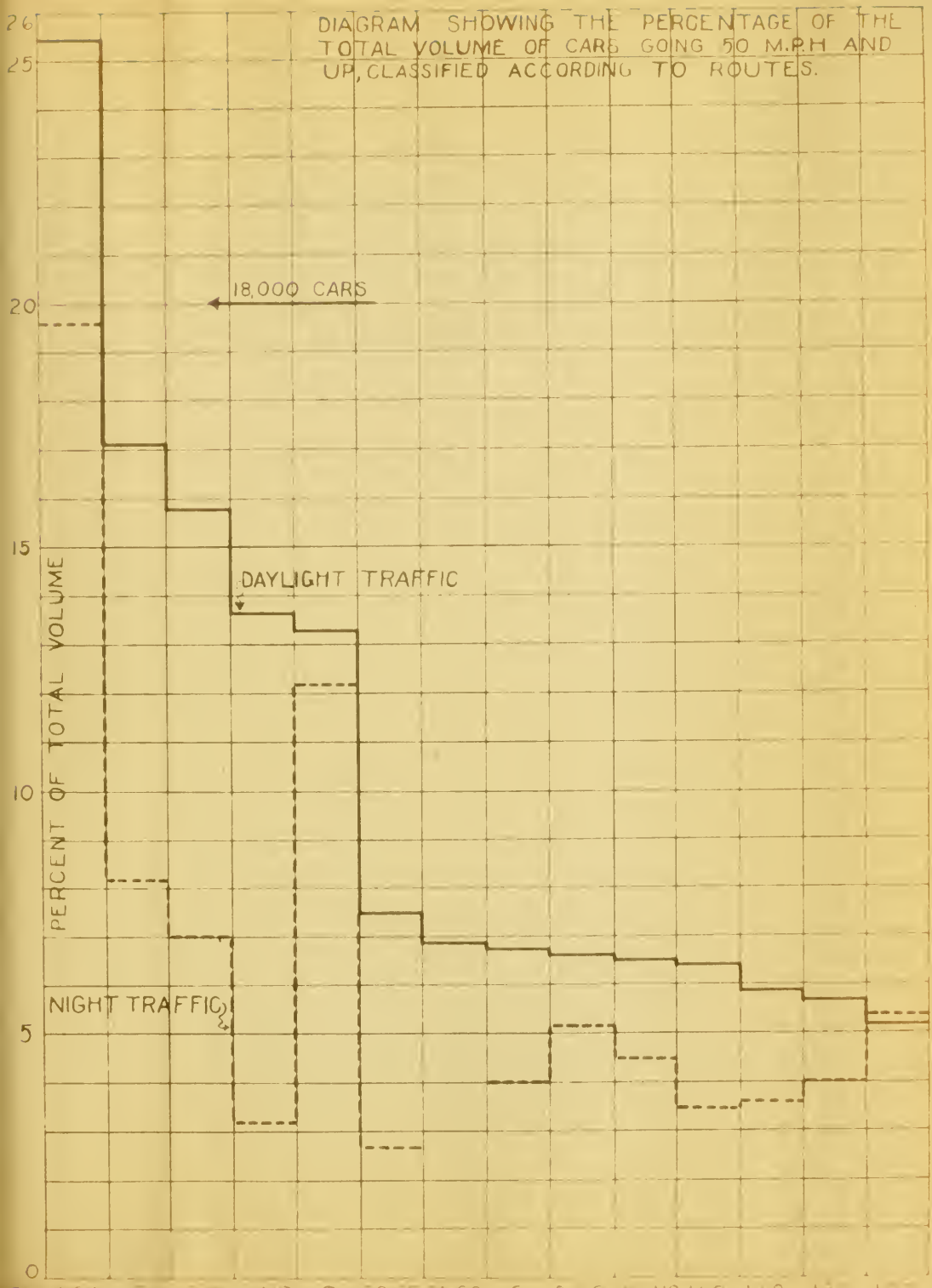


DIAGRAM SHOWING THE PERCENTAGE OF THE TOTAL VOLUME OF CARS GOING 50 M.P.H AND UP, CLASSIFIED ACCORDING TO ROUTES.
26
25
20
15
10
5
0
18,000 CARS
DAYLIGHT TRAFFIC
NIGHT TRAFFIC
PERCENT OF TOTAL VOLUME

Diagram of

SPEED CHARACTERISTICS & ACCIDENT RECORDS

FOR 1935 & 1936

ROUTE 1 BOSTON TO ATTLEBORO MASS

PREPARED BY THE
HIGHWAY TRAFFIC RESEARCH COMMONWEALTH PIER BOSTON
OCTOBER 1937

KEY
1935 ACCIDENT RATING
1936
AVERAGE SPEED LINE
MAXIMUM SPEEDS

ACCIDENT RATING CODE

KILLED	5
INJURED	2
PROPERTY DAMAGE	1

1935 ACCIDENT RECORD

TOTAL ACCIDENTS	220
KILLED	6
INJURED	294
PROPERTY DAMAGE	70

1936 ACCIDENT RECORD

TOTAL ACCIDENTS	214
KILLED	19
INJURED	273
PROPERTY DAMAGE	74

LEVEL STRAIGHTAWAYS TWO MAJOR ROUTE JUNCTIONS VISIBILITY GOOD

ROLLING COUNTRY GRADUAL CURVES SEVERAL STOP LIGHT INTERSECTIONS VISIBILITY FAIR

ROLLING GRADES GRADUAL CURVES A ROUTE JUNCTION VISIBILITY LIMITED AT INTERSECTIONS

LEVEL STRAIGHTAWAY STOP LIGHT VISIBILITY GOOD

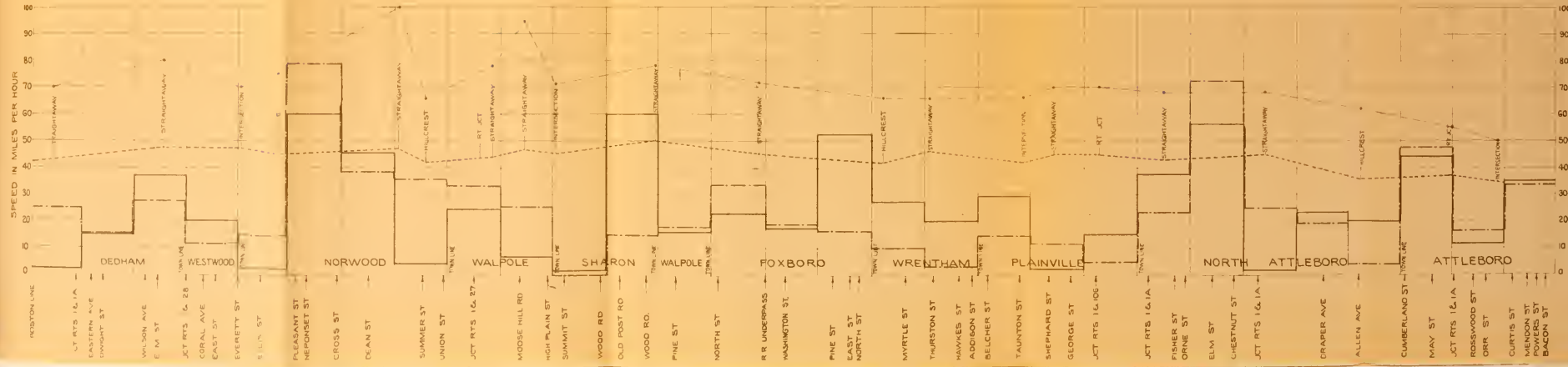
GRADES AND CURVES MAIN LINE GRADE CROSSING VISIBILITY FAIR

HARD GRADE GRADUAL CURVES ROLLING STRAIGHTAWAYS NUMEROUS INTERSECTIONS VISIBILITY FAIR

SEVERAL STOP LIGHTS LEVEL WITH SLIGHT CURVES A BY PASS VISIBILITY GOOD

SMALL FARM SECTION GRADUAL GRADES & CURVES VISIBILITY FAIR

ROUTE JUNCTIONS NUMEROUS INTERSECTIONS VISIBILITY FAIR



Braking and Approach Speeds at Hazards.

A special study was made of the speed of vehicles approaching and passing through a curve at the foot of a hill in Framingham, as indicated on the following page. This study was made on October 15, 1936 from 9:30 A.M. to 9:00 P.M. under fair and dry conditions. The object of this investigation was to determine the point at which braking began and the resultant reduction in speed due to braking. Speeds were observed at two permanent positions throughout the study; (1) at the point of the curve, and (2) at the hillcrest.

One hour observations were made also at intermediate points between the two permanent locations and at a point 50' on the other side of the point of the curve as indicated on the diagram.

From the "station speed curve" it will be observed that there is a sharp increase of speed near the top of the hill, from the point where the curve first comes into view and thence to a point 800' back from the curve. This is the point where braking was applied and resulted in an average decrease in speed of 4.5 miles per hour from this point down to a point 350' from the curve. The rest of the distance, to the beginning of the curve, shows a fairly constant speed with the minimum average speed being recorded at a point somewhere between 50' and 100' before the point of the curve is reached. From this point on we find a slight increase in speed as more of the curve is uncovered and better visibility is encountered.

It will be noted from the diagram that the speeds at the hillcrest and at the point of the curve show the same general average, crossing each other four times throughout the study. As a matter of fact the general average of the 4230 cars clocked at the hillcrest was 40.8 miles per hour while the general average of 4314 cars clocked at the point of the curve was 40.6 miles per hour showing that the hill itself had no resultant effect on the speed of cars approaching the curve since the average speeds at the top and at the foot of the hill are about identical.

It would seem to be a fair assumption that the average driver makes no attempt to slow down for a curve he sees some considerable distance ahead, even if he is going down a fairly substantial grade, but depends on his brakes to put and keep him in control within a point where he can see enough of the curve to give him braking distance. It may well be that all warning signs could be placed with reference to the average speed observed, prior to the actual hazard and the normal braking distance for that average speed. Admonitory signs a

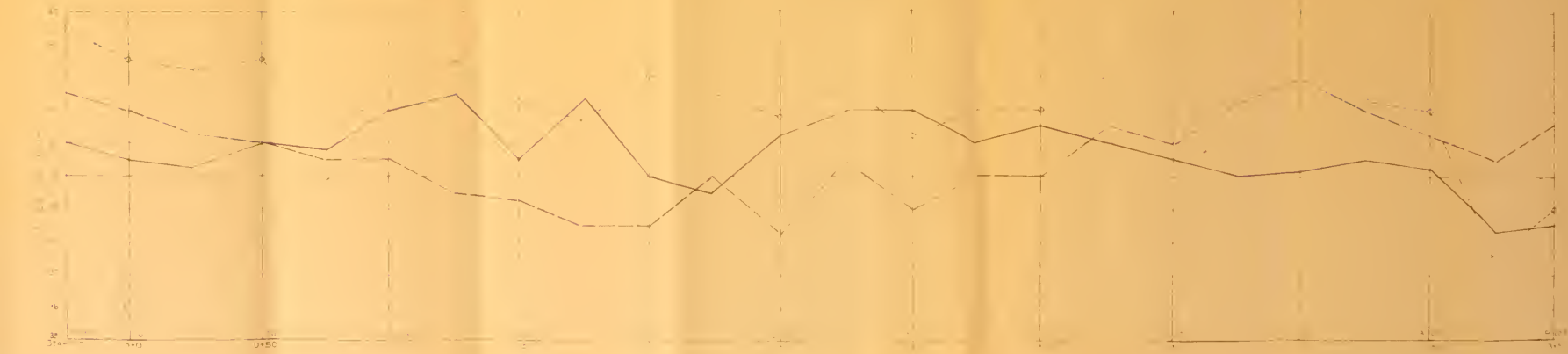
STUDY OF BRAKING & APPROACH SPEEDS AT HAZARD

HAZARD - CURVE - DOWN HILL

ROUTE 9 EAST BOUND

RESERVOIR HILL FRAMINGHAM MASS.

PURPOSE



COMMONWEALTH PLR BOSTON

considerable distance prior to the hazard probably are largely disregarded. The idea is worthy of further s udy as a means of reducing the number of admonitory signs and increasing the effectiveness of those actually used.

Speed at Railroad Underpass.

The diagram on the following page 114. shows the speed conditions at a railroad underpass in Wilbraham on route 20. On the west side of the underpass is situated the center of the Town of Wilbraham, which accounts for the fact that the speed at permanent station 1 is much lower than the speed on the east side of the underpass at permanent station 2, which is open country.

Six one-hour studies were taken also at intermediate points between these two permanent stations. It will be observed that the speeds recorded at the intermediate points check with the speeds at the permanent stations. For instance, on the diagram, we notice that at 10:30 A.M. the speed at station 1 and the speed recorded by the roving station are nearly the same. As the roving station moves to the east side of the underpass we find its recorded speed approaching that of station 2, until at 4:00 P.M. when the roving station moves closest to station 2, we find the speed at these two stations about equal. There is a slight grade ahead of the west bound traffic just after leaving the underpass. This also is a factor, to a minor degree, in lowering the speed in the west bound direction and increasing it in the east bound direction.

The final conclusion drawn from the effect of this hazard on the speed of cars approaching is, that east bound cars showed no decrease in speed, in fact there was a slight increase due to the fact that in going through the town, prior to entering the underpass, traffic naturally moved at fairly low speed, then encountered a down grade and at once entered open country. The reverse is true for cars going in the west bound direction. Traffic was moving at a much higher speed in west bound direction in the open country approaching the underpass and the town. In this direction we notice a material decrease in speed in vehicles approaching the hazard. For instance, on the diagram, at 1:30 P.M. the speed of the west bound traffic at station 2 was 37.5 miles per hour while at the same time the speed of this same west bound traffic at the roving station just east of the underpass was 33.0 miles per hour showing a decrease of 4.5 miles per hour due to the hazard.

Visibility at points between approximately 200' either side of the underpass is restricted to that same distance beyond the underpass. In other words, while actually in the hazard the driver has ordinarily a distance of not less than 400' with good visibility at all times within which to control his vehicle.

Special Study

BOSTON & ALBANY RAILROAD UNDERPASS

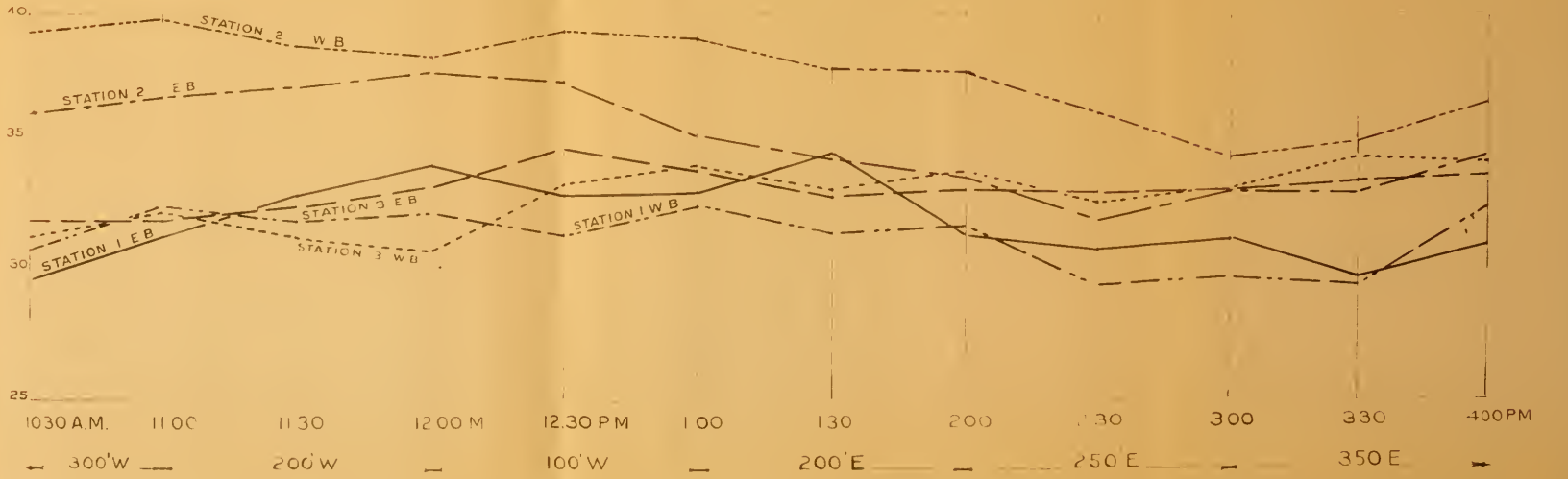
WILBRAHAM-ROUTE 20

TUESDAY 10-27-36 10.00 A.M. 4.00 P.M.

KEY

PERMANENT STA 1 W OF UNDERPASS
E.B TRAFFIC ——
W B - - - -
PERMANENT STA 2 E OF UNDERPASS
E.B TRAFFIC — - —
W B. TRAFFIC - - - —
MOVING STATIONS E. B — — —
W B - - - - -

Location of Observation Points



HIGHWAY TRAFFIC RESEARCH - COMMONWEALTH PIER BOSTON

Speed on Railroad Overpass.

On page [illegible] is a diagram of a speed study made at a railroad overpass where the railroad tracks passed under the highway traffic bridge in Palmer on route 20, and the highway under observation passes uphill and down through two reverse curves. Speeds were recorded at a permanent location just west of the bridge, supplemented by one hour observations at points up to 900' on each side of the bridge.

In this case it should be noticed that the traffic slows down quite materially approaching the bridge in both directions, and also that the speed is about the same in both cases just before the bridge is entered. Since the average speed of the approaching west bound traffic is higher than that of the approaching east bound traffic there is a larger decrease in the speed of this west bound traffic. For example, on the diagram, from the graph of the moving station west bound traffic, we find at a point 900' east of the bridge an average speed of 46.5 miles per hour while at 125' east of the bridge on the same graph the average speed is 32.4 miles per hour, a difference of 14.1 miles per hour. The difference in time would have no material effect in causing this decrease in speed, as all conditions of weather and volume remain virtually constant. The curve at the approach to the bridge and the bridge itself presented sufficient obvious hazard to cause this reduction in speed.

In considering the approaching east bound traffic we can compare the speed at the permanent station 100' west of the bridge with the speed 900' west of the bridge at the same time. The average speed at the permanent station of the east bound traffic was 33.4 miles per hour while at the same time the speed at a point 900' west of the bridge was 39.7 miles per hour for this same traffic, showing a decrease of only 6.3 miles per hour as compared with a decrease of 14.1 miles per hour in the west bound traffic.

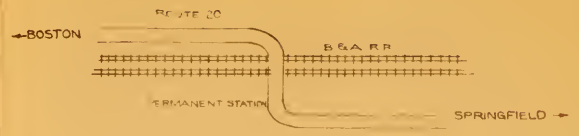
Special Study

RAILROAD OVERPASS - PALMER MASS

APPROXIMATELY 0.15 MILES WEST OF MONSON LINE

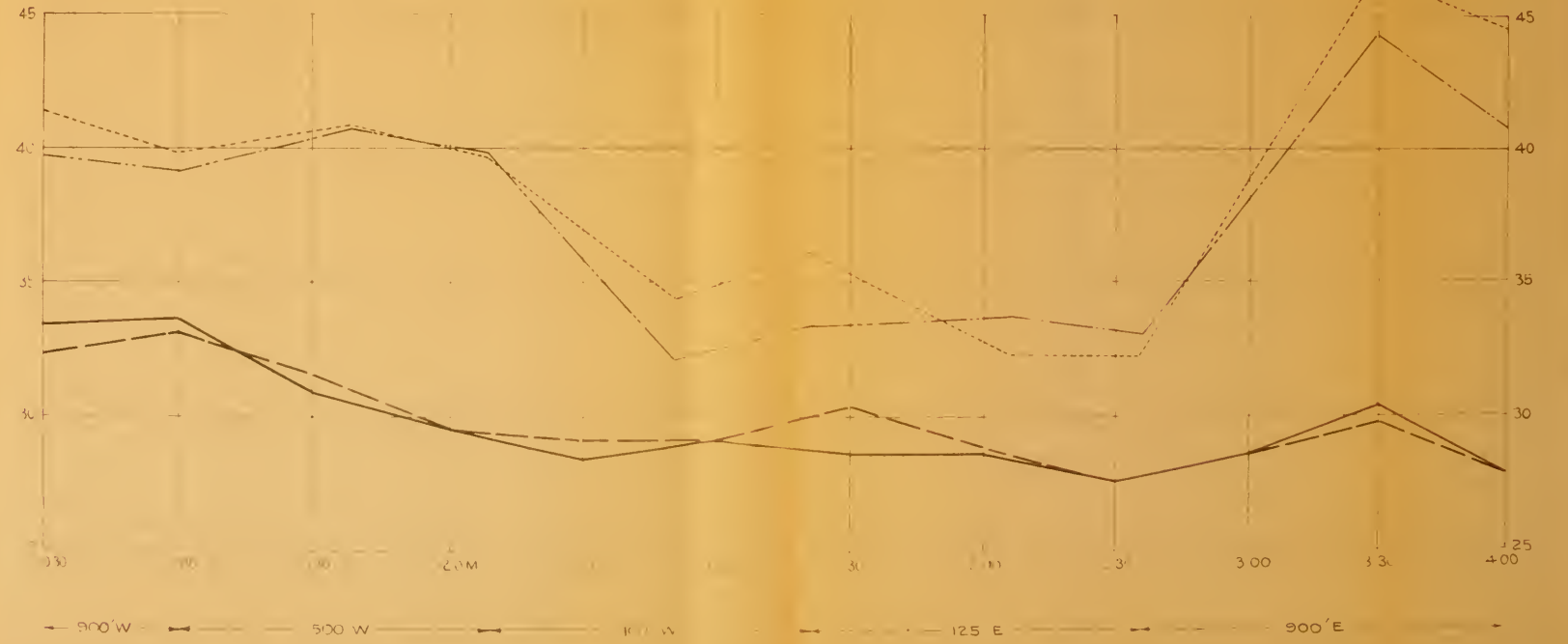
10 00 A M TO 4 00 P M

OCTOBER 28 1936



KEY

PERMANENT STATION EAST BOUND
" " WEST "
MOVING " EAST "
" " WEST "



YEARLY COMPARISON OF SPEEDS:

The object of this study is to determine the variation of speeds at the same time from year to year. The figures presented in the table below, comparing average speeds for 1934, 1935 and 1936, show maximum variation of only 0.7 miles per hour:

Yearly Comparison of Average Speeds at Same Locations

Number of Locations	1934	1935	1936
10	44.4 MPH	44.7 MPH	
9		45.0 "	44.3 MPH
6	45.4 "	46.1 "	45.6 "

This table would seem to indicate that the average speed at a given location under similar conditions tends to remain fairly constant from year to year unless some radical change is made in the territory immediately adjacent to the location under study.

A P P E N D I X

ROUTE NUMBERS	DAY NUMBER OF CARS	DAY AVERAGE SPEED	NIGHT NUMBER OF CARS	NIGHT AVERAGE SPEED	COMBINED NIGHT AND DAY NUMBER OF CARS	COMBINED NIGHT AND DAY AVERAGE SPEED	NUMBER OF LOCATIONS	NUMBER OF STUDIES
1-NORTH	40781	40.5	20742	34.4	61523	38.5	28	35
1-SOUTH	124520	43.2	97600	42.3	222120	42.8	22	113
1-A-NORTH	23886	36.7	1499	33.7	25385	36.5	13	14
1-A-SOUTH	8447	32.5	830	32.5	9277	32.5	7	7
2	38915	40.5	14340	36.4	53255	39.5	53	55
2-A	2074	29.8	1209	30.1	3283	29.9	1	1
3-NORTH	13949	35.7	8357	36.3	22306	35.9	21	21
3 SOUTH	31523	36.1	6317	34.7	37840	35.9	36	40
3 A SOUTH	35033	38.5	1490	38.7	36523	38.5	15	18
4	8116	35.6	4474	33.7	12590	34.9	13	13
5 AND 5 A	8171	39.3	2033	40.7	10204	39.6	9	9
6	86658	38.0	15370	36.8	102028	37.9	36	51
9	45142	39.3	36694	39.6	81836	39.4	53	57
12	15333	39.9			15333	39.9	12	12
15	784	49.9	1292	34.5	2076	40.3	2	3
16	3602	33.4	2120	34.6	5722	33.9	4	4
18	16457	34.1	4432	33.1	20889	33.9	16	27
20	73951	38.4	24995	37.0	98946	38.0	68	94
20-A	3555	26.5	701	25.0	4256	26.3	1	2
28-NORTH	89001	38.9	28590	36.1	117591	38.2	21	35
28 SOUTH	138424	36.9	20176	33.7	158600	36.5	66	76
37	6240	29.9			6240	29.9	1	2
38	14255	33.9	6724	30.3	20979	32.8	12	14
44	13959	35.9	5482	35.5	19441	35.8	14	25
58	385	25.1	202	23.7	587	24.6	1	1
106	6372	33.7	601	30.5	6973	33.4	14	14
107	25734	36.6	3851	36.6	29585	36.6	5	8
109	2875	37.0	1229	35.8	4104	36.6	6	9
110	12938	37.5	7781	38.5	20719	37.9	17	20
114	7582	32.6	1976	42.0	9558	34.5	6	7
122	3256	35.4	6715	37.9	9971	37.3	12	12
125	5975	39.8	2055	38.1	8030	39.4	10	10
126	3216	37.5	2378	36.3	5594	37.0	7	9
128	31423	36.7	3574	35.7	35002	36.6	18	23
132	2815	39.4			2815	39.4	2	2
135	7060	38.2	2175	38.5	9235	38.4	5	6
138	43360	37.6	10423	35.5	53783	37.2	21	33
140	18700	37.4	1393	35.7	20093	37.2	23	25
202 AND 32	4276	39.6	1137	41.3	5413	40.0	13	16
	1018743	38.2	350962	38.0	1369705	38.2	684	923

COMBINED DAY AND NIGHT CAR MILES 52,327,236
DAY AND NIGHT CARS CLOCKED 1,369,705
DAY AND NIGHT AVERAGE SPEED 38.2

GENERAL SUMMARY OF SPEED VOLUME DISTRIBUTION IN STATE — GROUPS WITH AVERAGE SPEEDS BY HOURS — DAY — APPENDIX

RTE	10 15	%	15 20	%	20 25	%	25 30	%	30 35	%	35 40	%	40 45	%	45 50	%	50 55	%	55 60	%	60 65	%	65 70	%	70 and up	%	CAR MILES	CARS CLOCKED	TOTAL TRAFFIC	AVERAGE SPEED
1 No	86	.21	144	.72	758	1.86	1874	4.59	3951	9.69	4484	25.71	9475	23.23	6243	15.44	3364	8.25	1434	3.52	575	1.41	157	.38	38	.09	1652348	40781	42009	40.5
1 So	316	.26	1000	.80	2231	1.78	4837	3.86	11222	9.01	9092	5.29	27478	22.97	26255	21.05	11468	9.34	8126	6.58	2242	2.60	789	.63	260	.20	5384511	124520	130321	43.2
1A No			10	.04	258	1.08	1707	7.19	6674	27.96	2634	17.64	4975	20.13	1831	7.67	1.5	.64	62	.26	0	.04	1				876447	23886	24300	36.7
1A So	161	1.91	345	4.09	942	11.15	1489	17.63	982	22.49	1800	21.31	1181	13.99	435	5.15	119	1.21	23	.27	5	.06					2743.69	8447	8633	32.5
2	14	.04	244	.63	1069	2.75	2704	6.9	6348	16.31	7965	20.47	2.3	20.67	5860	15.06	3721	9.56	1471	3.79	844	2.30	260	.72	100	.25	1576100	38915	40458	40.5
2A			9	.43	193	9.31	716	34.51	844	40.32	238	11.54	20	.96		.05											61835	2074	2074	29.8
3 No	31	.22	139	1.00	664	4.76	1900	13.67	3585	25.76	3434	24.62	2443	17.51	1187	8.51	467	3.35	72	.52	27	.19					497385	13949	14334	35.7
3 So	31	.10	554	1.64	1835	5.82	4474	14.19	6951	22.05	7044	22.33	5217	16.55	3352	10.63	1427	4.51	455	1.44	159	.51	52	.17	6	.02	1138203	31524	32481	36.1
3-A So	2	.01	92	.26	715	2.04	2076	5.92	7319	20.88	9.3	24.52	8438	24.04	4687	13.38	1157	3.30	496	1.39	127	.36	21	.06	5	.01	1349073	35033	35418	38.5
4	2	.03	70	.86	381	4.69	1058	13.05	2044	25.20	2190	26.98	1435	17.68	579	7.13	243	3.02	46	.54	15	.19	2	.03			288972	8116	8517	35.6
5TH SA	1	.01	53	.65	263	3.22	643	7.93	1280	15.66	1840	22.52	1877	22.95	1153	14.10	710	8.69	200	2.45	95	1.16	8	.10	5	.06	320987	8171	8294	39.3
6	11	.01	445	.51	3295	3.80	7740	8.93	16802	19.39	16536	20.77	19900	22.97	11851	13.79	4416	5.12	1121	1.30	293	.34	53	.06	11	.01	3288975	86658	89051	38.0
9	40	.09	437	.97	2073	4.59	3690	8.17	7279	16.13	9167	20.31	9457	20.95	6983	15.47	3639	8.06	1554	3.44	621	1.38	155	.34	47	.10	1773857	45142	45534	39.3
12			16	.10	363	2.37	1088	7.05	2581	16.83	3361	21.92	3518	22.94	2507	16.35	1241	8.12	386	2.52	175	1.14	43	.28	12	.08	611513	15333	15411	39.9
15					1	.13	7	.84	25	3.19	52	6.63	106	13.52	176	22.45	176	22.45	165	21.04	53	6.76	18	2.30	5	.64	39081	784	794	49.9
16	1	.03	10	.27	161	4.47	651	18.21	1417	39.33	865	24.01	325	9.02	100	2.77	48	1.33	14	.39	5	.14					120331	3602	3605	33.4
18	31	.14	140	1.15	397	8.49	2816	17.11	4142	25.17	3774	22.93	2520	15.31	1074	6.53	393	2.39	89	.54	23	.14	8	.04	2	.01	561714	16457	16555	34.1
20	308	.42	1164	1.57	4668	6.31	8498	12.17	13217	17.87	11803	17.72	11640	15.74	9124	12.34	6907	8.12	3339	4.51	1589	2.15	586	.74	188	.25	2840611	73951	75713	38.4
20 A	32	.90	186	5.23	267	35.66	978	27.51	750	21.08	256	7.23	76	2.14	9	.25											94243	3555	3574	26.5
28 No	48	.05	314	.35	1893	2.13	5653	6.35	14533	16.33	23600	26.52	24002	26.97	13113	14.74	4569	5.13	1035	1.15	189	.21	44	.05	13	.02	3460701	89001	91152	38.9
28 So	159	.12	1610	1.16	7583	5.48	16037	11.58	26458	20.56	25564	22.60	26571	19.19	16088	11.63	7027	5.08	2460	1.78	685	.50	127	.09	41	.03	5112259	138424	142668	36.9
37	16	.26	231	3.72	663	13.83	1808	29.17	1934	31.00	1021	16.35	303	4.86	58	.87	9	.14									186444	6240	6565	29.7
38	39	.27	307	2.15	969	6.80	2037	14.20	3904	27.39	4274	29.98	2012	14.11	541	3.84	149	1.04	15	.11	7	.05					4335.82	14255	14502	35.9
44	9	.07	120	.86	853	6.11	1869	13.39	3382	24.22	3191	22.86	2574	18.44	1263	9.06	355	2.56	124	1.32	30	.21	22	.16	5	.04	501503	13959	14225	35.9
58	4	.04	53	13.71	121	31.43	114	29.69	78	20.29	16	4.05	1	.26													9667	385	385	25.1
106	71	1.11	153	2.43	667	10.97	1008	15.87	1483	23.27	1455	22.90	888	13.94	410	6.43	175	2.75	46	.72	11	.17	1	.02			214843	6372	6442	33.7
107	4	.11	64	.25	761	2.96	1820	12.24	6219	16.48	6363	24.72	4603	17.89	2647	10.28	914	3.55	280	1.09	95	.37	35	.14	14	.05	942959	25734	26182	36.6
109			16	.50	112	3.50	348	10.90	699	21.91	662	23.02	527	18.33	259	9.04	127	4.42	54	1.88	23	.80	8	.28			106254	2875	2880	37.0
110	2	.04	53	.41	246	1.90	874	6.75	3070	23.73	3991	30.85	2925	22.61	1176	9.09	448	3.46	114	.88	31	.24	5	.04	3	.02	485454	12938	13100	37.5
114			117	1.54	1020	13.45	1851	24.40	2010	26.51	1151	15.18	791	10.43	423	5.58	223	2.94	67	.89	26	.34	2	.03	1	.01	247038	7582	7671	32.6
122	2	.06	29	.89	172	5.28	442	13.58	830	25.49	710	21.81	585	17.97	279	8.57	135	4.15	44	1.35	14	.43	8	.24	1	.03	116904	3256	3351	35.9
125	3	.03	50	.83	172	2.88	459	7.68	921	15.49	1240	20.76	1292	21.62	878	14.70	560	9.37	220	3.68	95	1.59	19	.32	2	.03	237997	5975	6034	39.8
126	2	.06	34	1.00	116	3.41	317	9.34	673	20.93	782	24.63	699	21.73	348	10.82	176	5.47	41	1.27	15	.47	3	.09			120503	3216	3245	37.5
128	6	.02	248	.77	1351	4.20	3600	11.19	7197	22.74	8011	25.49	6177	19.66	3029	9.64	1318	4.19	417	1.33	100	.32	17	.05	2	.01	1151499	31423	31988	36.7
132			6	.21	34	1.21	130	4.66	463	16.57	836	29.69	687	24.39	413	14.70	180	6.40	46	1.63	12	.43	2	.07	1	.04	110805	2815	2924	39.4
135			10	.21	125	1.71	378	5.28	1359	19.18	2061	29.14	1893	26.81	923	13.08	248	3.51	53	.75	13	.19	2	.03			271531	7060	7117	38.2
138	7	.02	191	.54	462	3.34	1431	9.53	930	21.14	10721	24.73	10881	25.11	4774	12.53	897	4.37	237	1.01	123	.28	23	.05	3	.01	1629170	43360	43733	37.6
140	8	.03	112	.60	621	3.38	1858	9.41	4108	21.48	4958	25.44	3986	21.32	2055	11.01	870	4.66	235	1.26	74	.40	12	.06	3	.02	698642	18700	18852	37.4
32ND 202			4	.21	122	2.85	367	8.67	643	15.03	901	21.07	969	22.66	726	16.97	392	9.17	110	2.57	27	.63	4	.09	5	.12	169350	4276	4284	39.6
TOTALS	1444		6771		24817		55786		92348		89841		84671		53790		21186		8693		2478		2455		763		3900 7378	101874	104436	
%	0.14		0.88		4.11		9.44		18.88		22.56		20.58		13.13		6.60		2.47		0.93		0.24		0.08	=100%		97.50%		

DAY AVERAGE SPEED 38.2 M.P.H.

General Summary Speed Volume & Distribution in 5 M.P.H. Groups with Average Speeds by Routes Night

Routes	10-15	%	15-20	%	20-25	%	25-30	%	30-35	%	35-40	%	40-45	%	45-50	%	50-55	%	55-60	%	60-65	%	65-70	%	70 Up	%	Car Miles	Cars Stocked	Total Traffic	Av. Spds.
1-North	297	1.43	652	3.14	1332	6.42	2861	13.80	5188	25.02	4917	23.71	3376	16.28	1457	7.03	461	2.22	136	.65	55	.26	7	.03	3	.01	713984	20742	21798	34.4
1-South	237	.24	665	.68	1686	1.73	4344	4.45	9784	10.02	16691	17.09	16783	17.18	21189	21.70	11648	11.92	4900	5.02	1951	2.01	497	.51	167	.17	1124054	97600	104937	42.3
1-A-No			4	.21	49	3.27	219	14.62	525	35.02	405	27.01	234	15.61	57	3.80	6	.40									50458	1499	1499	33.7
1-A-So	1	.12	8	.96	65	7.83	192	23.13	251	30.24	200	24.10	85	10.24	24	2.89	4	.49									26977	830	848	32.5
2	50	.35	179	1.25	708	4.92	1547	10.79	3356	23.36	3767	26.24	2690	18.76	1398	9.75	706	4.92	273	1.90	144	1.00	33	.23	15	.11	529321	14340	14575	36.9
2-A					65	5.38	426	35.24	576	47.64	174	14.67	13	1.07													36407	1209	1209	30.1
3-No.	1	.01	34	.41	280	3.35	1045	12.50	2176	26.04	1930	23.09	1663	19.90	690	8.26	259	3.10	65	.78	31	.37	2	.02	1	.01	303050	8357	8625	36.3
3-So.	5	.08	78	1.24	578	9.15	1239	19.47	1441	22.81	1170	18.49	834	13.20	537	8.50	215	3.40	78	1.24	70	.31	9	.14	2	.03	218986	6317	6578	34.7
3-A-So.			7	.47	69	4.63	149	10.00	248	16.64	235	15.78	306	20.54	246	16.51	117	7.85	38	2.56	11	.74	2	.13	2	.13	57689	1490	1631	38.7
4			77	1.72	374	8.36	770	17.21	1319	29.48	1011	22.60	578	12.92	237	5.31	86	1.92	8	.18	10	.22	1	.02			150671	4474	4902	33.7
5-No & 5-A			5	.25	25	1.23	53	2.60	278	13.67	501	24.64	590	29.02	350	17.22	171	8.41	43	2.12	15	.74	1	.05			82770	2033	2057	40.7
6			25	.16	510	3.32	1370	8.91	3815	24.82	4297	27.96	2744	17.85	1539	10.01	593	3.86	173	1.13	80	.52	48	.31	8	.05	4	.03	566163	15370	15618	36.8
9	25	.01	293	.80	1257	3.43	2814	7.67	5869	15.99	8077	22.01	8343	22.74	5586	15.22	2726	7.43	1095	2.98	438	1.19	128	.35	43	.12	1454091	36694	37305	39.6
15	1	.08	2	.16	23	1.78	226	17.49	397	30.73	387	29.95	191	14.78	48	3.71	16	1.24	1	.08							44523	1292	1295	34.5
16			7	.33	49	2.31	268	12.64	787	36.79	587	27.69	258	12.17	89	4.20	55	2.59	19	.90	8	.38					73400	2120	2122	34.6
18	4	.09	66	1.49	441	9.95	874	19.72	1231	27.77	931	21.01	506	11.42	254	5.73	76	1.71	21	.47	7	.16	1	.02			146866	4432	4437	33.1
20	74	.30	311	1.24	1437	5.75	2540	10.16	5178	20.52	5653	22.61	5234	20.93	3873	15.49	1834	7.36	364	1.46	116	.47	25	.09	3	.01	923790	24995	25449	37.0
20-A			44	6.28	291	41.51	263	37.52	87	12.41	9	1.28	7	1.00													17489	701	701	25.0
28-No.	25	.09	224	.78	1248	4.37	3611	12.64	7230	25.30	7394	25.88	5169	18.08	2334	8.16	865	3.03	309	1.08	103	.36	18	.06			1032057	28590	29692	36.1
28-So.	26	.13	242	1.20	1631	8.08	3780	18.73	5463	27.08	5479	27.16	3749	18.58	1362	6.75	406	2.01	98	.49	34	.17	5	.03	3	.02	680611	20176	20570	33.7
38	117	1.74	397	5.90	1027	15.42	1678	24.96	1588	23.62	1009	15.01	598	8.89	228	3.39	58	.87	15	.22	7	.03					203578	6724	6931	30.3
44	3	.06	31	.56	320	5.84	774	14.12	1397	25.48	1307	24.39	932	17.00	450	8.21	171	3.23	51	.93	8	.14	2	.04			194488	5482	5522	35.5
58	6	2.97	30	14.87	71	35.13	64	31.68	26	12.88	5	2.47															4783	202	202	23.7
106	12	2.00	25	4.16	102	16.97	123	20.46	145	24.13	105	17.46	44	7.32	21	3.64	3	.50									18313	601	605	30.5
107			9	.23	110	2.86	357	9.29	999	25.98	1057	27.45	706	18.32	405	10.52	153	3.97	41	1.07	14	.36					141050	3851	4042	36.6
109	4	.33	36	2.93	80	6.51	141	11.42	274	22.13	284	22.93	171	13.88	123	10.01	43	3.50	20	1.62	5	.41	2	.16			43972	1229	1229	35.8
110	1	.01	22	.28	147	1.89	509	6.54	1704	21.87	2033	26.13	1833	23.56	917	11.79	427	5.49	120	1.54	59	.76	16	.08	5	.06	299852	7781	7805	38.5
114			1	.05	15	.76	62	3.14	261	13.21	419	21.21	500	25.31	378	19.13	218	11.03	85	4.30	30	1.52	7	.35			83005	1976	1976	42.0
122	5	.07	62	.92	245	3.65	709	10.56	1317	19.61	1578	23.50	1398	20.82	813	12.11	384	5.72	156	2.32	65	.97	20	.30	13	.19	254798	6115	6881	37.9
125	3	.15	13	.63	79	3.84	159	7.74	427	20.78	483	23.50	399	19.42	288	14.01	120	5.84	40	1.95	14	.68	1	.05			78213	2055	2079	38.1
126	2	.08	19	.80	110	4.63	266	11.19	604	25.42	643	27.06	451	18.99	179	7.53	83	3.51	19	.80	16	.67	4	.08	2	.08	86229	2378	2379	36.3
128			6	.17	123	3.44	444	12.40	1023	28.58	1037	28.97	604	16.87	213	5.95	101	2.82	21	.59	6	.17	1	.03			127874	3579	3634	35.7
135					31	1.42	106	4.87	494	22.67	617	28.31	604	27.71	324	14.86	106	4.86	78	3.58	13	.60	6	.28	1	.05			83176	2175	2175	38.5
138	1	.01	66	.63	630	6.04	1499	14.38	2638	25.30	2470	23.69	1770	16.98	984	9.44	311	2.99	79	.76	21	.20	3	.03	1	.01	370435	10423	10493	35.5
140	3	.21	11	.79	54	3.88	174	12.49	350	25.14	395	28.36	266	19.10	133	9.68	40	2.87	9	.65							49783	1393	1419	35.7
32-202					9	.79	61	5.37	145	12.78	141	12.43	303	26.65	209	18.38	107	9.41	34	3.00	13	1.14	6	.53	3	.26	46944	1137	1137	41.3
Totals	903		3651		15281		35108		48884		47581		32697		19697		8178		3212		1258		488		267		13317858	350962	364357	37.95
Percent	0.26		1.04		4.35		10.17		13.54		13.60		9.30		5.60		2.33		0.91		0.36		0.14		0.08			96.3		

RTE No's	TOWN	CODE	MILES	CLOCKED	LANES
138	CANTON	464	19894	649	3
"	"	"	18712	623	3
"	EASTON	466	19160	523	3
"	"	"	8800	535	3
"	RAYNHAM	469	21561	602	3
"	"	"	15058	424	3
"	"	470	13611	442	3
"	"	"	11724	368	3
"	TAUNTON	471	15245	418	3
"	"	"	13778	404	3
44	Rehoboth	458	6904	196	2
"	"	"	6091	171	2
128	NEEDHAM	514	34409	1041	2
"	"	"	38447	1140	2
44	SEEKONK	459	13423	398	2
"	"	"	15279	450	2
1 South	WRENTHAM	14	12287	273	4
"	"	"	14744	325	4
110	STERLING	367	1800	50	2
"	"	"	2307	58	2
140	MILFORD	482	12258	338	2
"	"	"	13724	346	2
"	BERKELEY	496	11520	319	2
"	"		14212	319	2
6	DARTMOUTH	441	18183	586	4D
"	"		24073	612	4D
32 M6 202	WINCHENDON	543	7622	206	2
" "	"		7232	196	2
AVERAGE	SPEED	34.8	420306	12068	

RTE No's	TOWN	CODE	MILES	CLOCKED	LANES
138	CANTON	464	27763	668	3
"	"	"	25177	593	3
"	EASTON	1109	56758	1425	3
"	"	"	52216	1334	3
"	RAYNHAM	469	29632	807	3
"	"	"	24048	616	3
"	"	470	48728	1283	3
"	"	"	36573	992	3
"	TAUNTON	471	16899	419	3
"	"	"	14998	382	3
44	Rehoboth	458	11231	346	2
"	"	"	13421	380	2
128	NEEDHAM	514	45583	1310	2
"	"	"	49247	1479	2
44	SEEKONK	459	13591	415	2
"	"	"	15044	457	2
1-South	WRENTHAM	14	40283	824	4
"	"	"	34138	680	4
110	LANCASTER	368	3612	90	2
"	"	"	3509	93	2
140	HOPEDALE	483	22058	555	2
"	"	"	18190	469	2
"	BERKELEY	497	10895	275	2
"	"	"	14658	356	2
6	DARTMOUTH	441	27262	774	4D
"	"	"	32338	888	4D
32 M6 202	WINCHENDON	543	3468	101	2
" "	"	"	3516	100	2
AVERAGE	SPEED	38.4	694836	18111	

Straightaways. Wet Roads - Night

Rte. Nos	Town	Code	Car Miles	Clocked	No. of Lanes
138	Raynham	470	4448	151	3
"	"	"	5095	169	3
"	Canton	462	6328	199	3
"	"	"	9007	292	3
"	Taunton	471	6440	173	3
"	"	"	6186	176	3
128	Needham	514	5546	167	2
"	"	"	5424	167	2
1-So.	Walpole	10	14433	327	4
"	"	"	10709	320	4
110	Sterling	367	3339	95	2
"	"	"	2784	77	2
140	Berkley	496	1972	58	2
"	"	"	1219	32	2
Totals			82930	2403	

Average Speed 34.5 M.P.H.

Straightaways - Dry Roads - Night - 1961 Supplement

Rte Nos.	Town	Code	Car Miles	Clocked	No. of Lanes
138	Raynham	470	7766	215	3
"	"	"	7550	214	3
"	Canton	463	10296	229	3
"	"	"	11399	269	3
"	Taunton	471	6625	171	3
"	"	"	6472	185	3
128	Needham	514	6788	205	2
"	"	"	7516	230	2
1-So.	Wrentham	13	55513	1298	4
"	"	"	19307	500	4
110	Lancaster	368	3465	88	2
"	"	"	5081	139	2
140	Berkley	497	1498	41	2
"	"	"	1058	26	2
Totals			150334	3810	

Average Speed 39.5 M.P.H.

STRAIGHTAWAYS ICY ROADS DAYS

ROUTE NUMBER	TOWN	CODE	CAR MILES	CARS CLOCKED	LANES
44	Middleboro	451	2655	86	2
"	"	"	2333	81	2
"	"	"	3672	108	2
"	"	"	5058	147	2
"	"	452	6114	164	3
"	"	"	5852	157	3
"	Taunton	455	10272	302	2
"	"	"	10287	323	2
"	Raynham	454	5178	151	3
"	"	"	6106	191	3
"	Rehoboth	457	6969	216	2
"	"	"	6897	205	2
"	Seekonk	459	8599	250	2
"	"	"	8354	281	2
138	Milton	460	12348	424	4
"	"	"	15058	448	4
140	Taunton	494	6060	194	2
"	"	"	5758	200	2
18	Abington	426	5783	209	2
"	"	"	6642	234	2
"	"	427	7093	235	2
"	"	"	8265	290	2
			155358	4951	
			AVERAGE SPEED	31.4	

TABLE 4 APPENDIX

ROUTE NUMBER	TOWN	CODE	CAR MILES	CARS CLOCKED	LANES
44	Middleboro	451	1716	53	2
"	"	"	1241	40	2
"	"	"	1978	60	2
"	"	"	1615	51	2
"	"	452	2486	72	3
"	"	"	3757	86	3
"	Raynham	454	2669	81	3
"	"	"	2183	67	3
"	Taunton	455	7557	224	2
"	"	"	6215	187	2
"	Rehoboth	457	3782	115	2
"	"	"	3961	118	2
"	Seekonk	459	6128	206	2
"	"	"	6394	194	2
138	Milton	460	6264	201	4
"	"	"	8061	267	4
140	Taunton	494	2078	68	2
"	"	"	1863	57	2
15	Sturbridge	116	9462	287	2
"	"	"	21426	629	2
18	Abington	426	3269	127	2
"	"	"	4785	172	2
	"	427	3158	103	2
"	"	"	4851	163	2
AVERAGE	SPEED	32.1	116389	3630	

AT 28 OQUIN'S LANES PAC. AIR % DRY. 212 TIRE TODAY [illegible] % MI NORTH BOUND ONLY RETURNING FROM CAPE CON-SUNDAY

DATE	CODE	HAZARD	10/15	15/20	20/25	25/30	30/35	35/40	40/45	45/50	50/55	55/60	60/65	65/70	70 MPH UP	CAR MILES	CARS CLOCKED	AVERAGE SPEED
7/28/35	173	CURVE & DIP			3	118	460	771	761	474	128	38	1		1	108858	2755	39.5
" "	174	INTERSECTIONS	6	49	176	547	1025	648	321	142	18	8				97243	2940	33.1
" "	175	CURVE & INTER		34	230	711	961	743	303	74	16					99137	3072	32.3
" "	176	INTERSECTIONS		107	604	809	766	864	340	171	23	6				116499	36.90	31.6
			6	190	1013	2185	3212	3026	1725	861	185	52	1		1	421737	12457	33.7
		%	05	152	813	17.54	25.79	24.29	13.85	6.91	1.48	.42	.01		01			

100%

MONDAY

7/29/35	173	CURVE & DIP		2	3	21	34	63	107	96	54	30	12	2	1	18463	425	43.4
" "	174	INTERSECTIONS		3	11	18	59	103	127	102	51	19	5	1		20329	494	41.1
" "	175	CURVE & INTER		1	13	41	63	84	67	36	18	5				12339	330	37.4
" "	176	INTERSECTIONS			3	20	31	69	98	75	34	26	5	2	1	15621	364	42.9
				6	30	100	187	321	394	309	157	80	22	5	2	66752	1613	41.4
		%		.37	1.86	6.20	11.59	19.91	24.43	19.16	9.73	4.96	1.36	.31	.12	=100%		

THE ABOVE STUDIES TAKEN AT THE SAME LOCATION SUNDAY AND AGAIN ON MONDAY SHOW THE EFFECT OF VOLUME ON SPEED.

Summary of Straightaways-Fair Weather Dry Roads-Day Only Distribution by 5 M.P.H. Speed Groups with Average Speeds. Table 6 - Appendix

Lanes	Locations	Studies	Hours	Cars	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70 & Up	Average Speed
2	19	21	175	17161	5	87	614	1364	3062	3891	3708	2454	1270	506	159	29	12	38.9
			Per Cent	of Cars	.03	.51	3.58	7.95	17.84	22.67	21.61	14.30	7.40	2.95	.93	.16	.07	
3	28	31	252	44618	12	69	518	1670	4774	7826	10575	8832	5676	2877	1249	410	130	43.2
			Per Cent	of Cars	.03	.15	1.16	3.74	10.70	17.54	23.70	19.80	12.72	6.45	2.80	.92	.29	
4	11	21	152	35459	10	36	171	587	1781	3798	7287	8027	7570	3815	1709	495	173	45.6
			Per Cent	of Cars	.03	.10	.48	1.65	5.02	10.71	20.55	22.64	21.35	10.76	4.82	1.40	.49	
4	6	6	11	2400		6	22	42	125	266	397	558	498	287	158	35	6	47.2
Divided			Per Cent	of Cars		.25	.92	1.75	5.21	11.08	16.54	23.25	20.75	11.96	6.58	1.46	.25	
6	9	10	21	8505	2	20	126	280	744	1207	1939	2003	1252	574	255	74	29	43.9
Divided			Per Cent	of Cars	.02	.24	1.48	3.29	8.75	14.19	22.80	23.55	14.72	6.75	3.00	.87	.34	

Summary of Straightaways-Fair Weather Dry Roads-Night Only Distribution by 5 M.P.H. Speed Groups with Average Speeds.

Lanes	Locations	Studies	Hours	Cars	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70 & Up	Average Speed
2	13	14	79	3810		21	165	401	856	924	748	412	213	59	11			37.3
			Per Cent	of Cars		.55	4.33	10.53	22.47	24.25	19.63	10.81	5.59	1.55	.29			
3	22	25	91	10383	3	33	226	739	2002	2545	2529	1450	560	191	81	21	3	39.0
			Per Cent	of Cars	.03	.32	2.18	7.12	19.28	24.51	24.36	13.96	5.39	1.84	.78	.20	.03	
4	8	20	143	23977	7	25	140	519	1611	2898	5823	6088	3901	1769	842	268	88	44.9
			Per Cent	of Cars	.03	.10	.58	2.16	6.72	12.09	24.28	25.39	16.27	7.38	3.51	1.12	.37	
4	4	4	7	1197			4	20	68	148	208	255	211	153	82	36	12	47.7
Divided			Per Cent	of Cars			.33	1.67	5.68	12.37	17.38	21.30	17.63	12.78	6.85	3.01	1.00	
6	5	7	41	8895	4	22	128	340	910	1724	2306	1782	993	452	174	48	12	42.5
Divided			Per Cent	of Cars	.05	.25	1.44	3.82	10.23	19.38	25.92	20.03	11.16	5.08	1.96	.54	.14	

SUMMARY OF CURVES FAIR WEATHER DRY ROADS DAY HOURS ... WITH AVERAGE SPEEDS APPENDIX

NUMBER OF LANES	NUMBER OF LOCATIONS	NUMBER OF STUDIES	NUMBER OF HOURS	NUMBER OF CARS	10/15	15/20	20/25	25/30	30/35	35/40	40/45	45/50	50/55	55/60	60/65	65/70	70 AND UP	AVERAGE SPEEDS
2	7	10	65½	6903	5	69	325	1	1	2 3	1 47	041	5 2 1	15	10			34.4
			PERCENT OF CARS		07	93	4.71	1 16	2 1	28 20	1 08	4 66	1 19	14	02			
3	10	10	68	7990	3	31	244	668	1566	1842	1869	1145	499	102	17	7	1	38.4
			PERCENT OF CARS		.04	.39	3.05	8.36	19.55	23.05	23.39	14.33	6.25	1.28	.21	.09	.01	
4	4	4	28½	7698		6	88	266	717	1286	1956	1823	1003	375	140	28	10	43.1
			PERCENT OF CARS			08	1.14	3.46	9.31	16.71	25.41	23.68	13.03	4.87	1.82	.36	.13	
6 Divided	1	2	8	2834		8	44	118	298	564	664	580	377	120	43	9	4	42.3
			PERCENT OF CARS			28	1.55	4.16	10.52	19.90	23.61	20.47	13.30	4.23	1.52	.32	.14	

SUMMARY OF CURVES FAIR WEATHER DRY ROADS NIGHT ONLY DISTRIBUTIONS BY S. M. P. H. SPEED GROUPS WITH AVERAGE SPEEDS

NUMBER OF LANES	NUMBER OF LOCATIONS	NUMBER OF STUDIES	NUMBER OF HOURS	NUMBER OF CARS	10/15	15/20	20/25	25/30	30/35	35/40	40/45	45/50	50/55	55/60	60/65	65/70	70 AND UP	AVERAGE SPEEDS
2	5	6	28½	1735	1	21	123	279	529	444	244	74	14	1				33.5
			PERCENT of CARS		06	1.21	7.09	16.08	30.49	25.59	14.06	4.27	.92	.23				
3	10	11	36	3422		21	152	350	836	846	655	371	137	41	10	3		36.6
			PERCENT of CARS			.61	4.44	10.23	24.43	24.72	19.14	10.84	4.01	1.20	.29	.09		
4	3	3	12	2762		1	67	159	556	731	660	382	132	51	20	3		38.4
			PERCENT of CARS			.03	2.43	5.76	20.13	26.47	23.90	13.83	4.78	1.85	.72	.10		
6 Divided	1	2	16	2969	2	4	34	132	363	606	746	646	316	92	24	2	2	41.3
			PERCENT of CARS		.07	.13	1.14	4.45	12.23	20.41	25.12	21.76	10.64	3.10	.81	.07	.07	

THE ABOVE TABLE COVERS ONLY AVERAGE CURVES - BLIND - SHARP AND UNUSUAL CURVES OMITTED

Summary of Intersects - Fair Weather - Roads - Day Only - Distribution by 5 M.P.H. Speed Groups with Average Speeds - Table 8 - Type A

Lanes	Locations	Studies	Hours	Cars	10/15	15/20	20/25	25/30	30/35	35/40	40/45	45/50	50/55	55/60	60/65	65/70	70 & Up	Average Speed
2	12	13	104	1544	8	5	44	1033	2312	2401	1757	1008	382	111	7	8	1	36.7
			Per Cent	of Cars	.08	.1	4.44	10.82	24.21	25.4	18.40	10.56	4.00	1.23	.24	.08	.01	
3	10	11	76	1685	36	270	462	1134	2848	4276	4110	2278	872	343	91	8	3	38.4
			Per Cent	of Cars	2	1.61	2.73	7.30	16.9	25.41	24.42	13.54	5.18	2.04	.54	.05	.02	
4	10	14	137½	4773	9	354	181	5043	13255	15680	8311	2584	442	51	9			35.2
			Per Cent	of Cars	.02	.74	4.16	10.5	27.77	32.85	17.43	5.41	93	.11	.02			

Summary of Intersections - Fair Weather - Roads - Night Only - Distribution by 5 M.P.H. Speed Groups with Average Speeds

Lanes	Locations	Studies	Hours	Cars	10/15	15/20	20/25	25/30	30/35	35/40	40/45	45/50	50/55	55/60	60/65	65/70	70 & Up	Average Speed
2	7	7	30	2033		17	109	155	486	564	383	153	50	14	2			35.4
			Per Cent	Cars		.84	5.36	7.63	23.91	27.74	18.84	7.52	2.46	.69	.10			
3	8	8	23	3763	36	124	345	555	824	912	530	243	79	19	16			33.9
			Per Cent	of Cars	.96	3.30	8.64	14.75	21.56	24.24	14.08	6.46	2.09	.50	.42			
4	5	5	22	5780	15	84	249	708	2043	1724	734	156	36	6	1	1		33.7
			Per Cent	of Cars	.26	1.45	4.31	12.25	35.43	29.81	12.69	2.70	.62	.10	.04	.04		

Summary of Intersects - Fair Weather - Dry Roads - Day Only - Distribution by 5 M.P.H. Speed Groups with Average Speeds

Lanes	Locations	Studies	Hours	Cars	10/15	15/20	20/25	25/30	30/35	35/40	40/45	45/50	50/55	55/60	60/65	65/70	70 & Up	Average Speed
All	42	42	160	5617	211	858	2315	5425	9275	11417	11784	8333	4413	1764	687	162	40	38.4
Lanes			Per Cent	of Cars	3.7	15.1	4.22	9.56	6.34	20.11	20.76	14.68	7.77	3.11	1.21	.29	.07	

Summary of Intersects - Fair Weather - Dry Roads - Night Only - Distribution by 5 M.P.H. Speed Groups with Average Speeds

Lanes	Locations	Studies	Hours	Cars	10/15	15/20	20/25	25/30	30/35	35/40	40/45	45/50	50/55	55/60	60/65	65/70	70 & Up	Average Speed
All	31	31	124	27793	143	58	15.5	303+	+500	2225	5651	4026	2019	68	228	44	13	37.8
Lanes			Per Cent	of Cars	.51	2.09	5.56	10.9+	16.19	15.79	20.33	14.63	7.49	2.47	.82	.15	.05	

TABLE 4 APPENDIX

VOLUME SPEED RANGE ANALYSIS ON KEY ROUTES — DAY ONLY

Route Number	Low Flow	Low Number of Cars	Low %	Intermediate Flow	Intermediate Number of Cars	Intermediate %	Highest Volume 10 Mi Range	Number of Cars	%	High Flow	High Number of Cars	High %	Average Speed For Route	Maximum Speed For Route	Total Cars
1 No	10 to 30 MPH	3012	7.38	30 to 50 MPH	32201	78.97	35 to 45 MPH	19957	48.94	50 MPH & up	5568	13.65	MPH 40.5	MPH 80	40781
1 So	" "	8384	6.74	" "	84501	67.86	40 " 50 "	54157	43.56	" "	31635	25.40	" 43.2	" 87	124520
2	" "	4031	10.37	" "	28218	72.51	35 " 45 "	16010	41.14	" "	6666	17.12	" 40.5	" 84	38915
3 So	" "	6874	21.80	" "	22555	71.55	30 " 40 "	13980	44.34	" "	2094	6.65	" 36.1	" 75	31523
3 A So	" "	2885	8.23	" "	29722	84.85	35 " 45 "	17721	50.59	" "	2426	6.92	" 38.5	" 72	35033
6	" "	11491	13.25	" "	69249	79.92	35 " 45 "	40496	46.74	" "	5918	6.83	" 38.0	" 80	86658
9	" "	6240	13.82	" "	32886	72.86	35 " 45 "	18624	41.26	" "	6016	13.32	" 39.3	" 78	45142
20	" "	15158	20.50	" "	47084	63.67	30 " 40 "	26320	35.59	" "	11709	15.83	" 38.4	" 88	73951
28 No	" "	7908	8.88	" "	75253	84.56	35 " 45 "	47607	53.49	" "	5840	6.56	" 38.9	" 84	89001
28 So	" "	25389	18.34	" "	102691	74.18	30 " 40 "	60022	43.36	" "	10344	7.48	" 36.9	" 80	138424
107	" "	3979	15.47	" "	20427	79.37	30 " 40 "	13177	51.20	" "	1328	5.16	" 36.6	" 78	25754
128	" "	5205	16.57	" "	24364	77.53	30 " 40 "	15158	48.23	" "	1854	5.90	" 36.7	" 74	31423
138	" "	5791	13.36	" "	35086	80.92	35 " 45 "	20308	46.84	" "	2483	5.72	" 37.6	" 73	43360
140	" "	2596	13.85	" "	14910	79.75	30 " 40 "	8865	47.42	" "	1194	6.40	" 37.4	" 77	18700
Totals		108943	13.24		619147	75.22		372482	45.25		95075	11.54	" 38.5		823165

NIGHT ONLY

Route Number	Low Flow	Low Number of Cars	Low %	Intermediate Flow	Intermediate Number of Cars	Intermediate %	Highest Volume 10 Mi Range	Number of Cars	%	High Flow	High Number of Cars	High %	Average Speed For Route	Maximum Speed For Route	Total Cars
1 No	10 to 30 MPH	5142	24.79	30 to 50 MPH	14938	72.04	30 to 40 MPH	10105	48.73	50 MPH & up	662	3.17	MPH 34.4	MPH 85	20742
1 So	" "	6932	7.10	" "	71511	73.27	40 " 50 "	45442	46.56	" "	19151	19.63	" 42.3	" [illegible]	97600
2	" "	2484	17.33	" "	10685	74.51	30 " 40 "	6597	46.00	" "	1171	8.16	" 36.9	" 78	14340
3 So	" "	1891	29.94	" "	4102	64.93	30 " 40 "	2731	43.25	" "	324	5.13	" 34.7	" 75	6317
6	" "	1905	12.39	" "	12853	83.63	30 " 40 "	8072	52.52	" "	612	3.98	" 36.8	" 75	15370
9	" "	4389	11.97	" "	27875	75.96	35 " 45 "	16420	44.75	" "	4430	12.07	" 39.6	" 78	36694
20	" "	4362	17.45	" "	18886	75.56	35 " 45 "	10885	43.55	" "	1747	6.99	" 37.0	" 72	24995
28 No	" "	5108	17.87	" "	22187	77.60	30 " 40 "	14684	51.36	" "	1295	4.53	" 36.1	" 69	28590
28 So	" "	5679	28.14	" "	13951	69.14	30 " 40 "	9942	49.28	" "	546	2.72	" 33.7	" 72	20176
107	" "	476	12.36	" "	3167	82.24	30 " 40 "	2056	53.39	" "	208	5.40	" 36.6	" 64	3851
128	" "	573	16.02	" "	2877	80.37	30 " 40 "	2060	57.55	" "	129	3.61	" 35.7	" 67	3579
138	" "	2196	21.06	" "	7812	74.95	30 " 40 "	5058	48.53	" "	415	3.99	" 35.5	" 72	10423
140	" "	242	17.37	" "	1104	79.26	30 " 40 "	745	53.48	" "	47	3.37	" 35.7	" 58	1393
Totals		41319	14.57		211954	74.61		134797	47.45		30737	10.82	" 36.5		284070

Table of Comparative Speeds on Straightaways Only - Fair & Dry Conditions - Covering 21 Routes - 67550 Cars - Day & Night Combined - All Lanes.

Rural					Suburban					Urban				
Rte. Nos.	Car Miles	No. of Cars	40 M.P.H. up	50 M.P.H. up	Rte. Nos.	Car Miles	No. of Cars	40 M.P.H. up	50 M.P.H. up	Rte. Nos.	Car Miles	No. of Cars	40 M.P.H. up	50 M.P.H. up
1-North	51898	1224	805	207	1-A-North	89610	2262	1138	78	1-North	9971	299	55	1
	53803	1262	865	230		88800	2276	1058	65		15067	392	187	33
	45058	971	841	309	3-South	3575	83	47	23		13359	393	52	1
	60838	1387	1118	208		3980	111	36	3		12027	315	142	20
	4380	129	32	3		20307	518	245	47	1-South	30152	712	546	57
	5859	162	45	5		24874	586	391	93		40217	764	597	88
	4529	114	54	15		7213	182	91	17	2	23163	642	159	5
	5202	137	66	9		6692	184	59	4		24063	681	155	3
1-South	47421	981	841	439	3-A-South	98085	2233	1788	337	1-A-North	17870	509	113	5
	32896	734	542	203		71737	1706	1210	122		17333	526	59	0
	31870	705	559	234	4	19399	540	156	11	2	15103	441	72	0
	26423	584	460	204		17074	490	117	5		8669	246	48	0
	18305	418	303	100		8297	252	36	0	3-North	32361	1039	42	0
	16005	399	228	38		6268	194	32	2		27151	851	59	1
	75369	1522	1396	735	5	28335	694	383	79		8732	257	54	14
	83293	1758	1516	729		24921	596	407	104		12933	375	82	2
2	4621	104	72	30		28222	694	404	83	9	48396	1294	434	21
	6589	148	104	36		24218	600	334	49		52591	1467	440	29
	16850	433	207	28	9	8776	200	145	45		62377	1611	729	21
	23895	572	346	95		17408	398	279	99		39856	1078	148	3
	12016	303	175	32		7687	171	122	38		47015	1296	323	16
	13180	318	191	57		25568	609	412	86	28-South	6976	199	56	1
3-South	11161	266	165	44	18	9654	301	46	2		7419	200	67	13
	8161	184	135	48		13699	396	56	6		12108	360	60	3
6	12137	305	161	41		7681	230	42	3		8912	256	51	6
	15464	387	219	51		9648	305	37	2	44	10272	302	68	3
12	21976	515	334	111	28-North	74593	1905	951	95		10287	323	55	5
	23267	538	386	136		59655	1359	660	69		7657	226	39	1
20	7640	171	121	51		18163	469	228	21		6215	187	34	0
	6826	156	111	40		19839	524	235	39	107	20390	579	141	8
	9940	237	162	33		10621	291	97	6		23941	663	194	13
	9227	216	142	38		11256	310	104	10		6448	191	25	2
28-South	12863	302	208	49		9469	264	79	9		9036	260	42	0
	15753	352	285	90		10274	290	92	12	125	5943	180	37	2
	17972	446	249	27	28-South	12809	355	87	9		7449	225	32	0
	16304	387	244	56		17815	467	193	17		4443	131	26	1
109	10212	232	154	56	107	72830	1764	1026	227		5728	173	15	0
	7274	171	103	34		78292	2020	908	88	140	13707	381	117	10
	4335	111	58	11		11680	274	180	50		13932	378	91	9
	4376	113	54	6	-	15425	391	178	18					
Total	855188	19454	14057	4866		1093309	27694	14098	2073		740069	20402	5646	397
	Av. Speed	44.0	% 72.3	% 25.0		Av. Speed	39.5	% 50.9	% 7.5		Av. Speed	36.3	% 27.7	% 1.1

VIII GENERAL SUMMARY AND CONCLUSIONS

The eighteen months covered by this report, in addition to the twenty months of previous work by this same group of people, have brought out some very interesting facts. We have the record of what over 21 million drivers were doing at the time we observed them, and we have the record of how 668,000 pedestrians were obeying the traffic lights on the State Highways and numbered routes in Massachusetts. (All remarks in this report apply to the above territory unless otherwise so stated).

The primary object of this project was to gather data that would enable the proper authorities to reduce automobile accidents. Obviously before a cure can be accomplished the cause of the trouble must be ascertained. We have, therefore, tried to find out why, when and where accidents occurred, and this report sets forth this data with an analysis of the pertinent facts.

It is practically impossible to say how many automobile accidents are due to a single cause, because so few of them are investigated carefully enough to determine an exact cause, and some accidents have a combination of causes. The statistician must study the report and determine by his best judgment what was the probable cause and to record that as the cause of the accident. There is no question but what reckless driving and speed cause at least one-half of our accidents, with careless pedestrians ranking next in order as the cause of accidents.

Probably the question most frequently asked us is concerning speed, especially speed on the new and modern roads. A general answer to this is that modern roads and modern cars have increased speed, and that speed has increased the number and severity of accidents.

Last year twelve routes, all modern high speed roads, produced 58.9% of our accidents, 54.4% of our fatalities, and 57.9% of our injuries. Route 1 had the worst record with 1,205 accidents, 8.8% of the total; 27 deaths, 10% of the total; and 1,377 injuries, 9% of total.

The largest increase in accidents was in the city of Lawrence, which showed 128 more than the previous year. The greatest decrease was in the town of Ware which showed 38 fewer accidents than in 1937. The greatest percentage of increase was in Barre, and the greatest percentage of decrease was in Provincetown which showed a decrease of 100%. This was largely due to a change in their traffic regulations, effective last year, as a result of a traffic survey made for the town by this project.

On the numbered routes and State Highways of Massachusetts the records show that accidents increased in 198 towns and cities last year, accidents decreased in 127 towns, while 30 towns showed no change.

Our records show: -

1. The better the road the worse the accident record.

2. A location, bad from either an accident or violation standpoint, will not change its nature except under enforcement, a change in physical characteristics, or a change in existing traffic regulations.

3. The prevailing type of violation at any given point will eventually become the major cause of later accidents occurring at this location.

4. An increase in driving violations results in an increase in accidents, while a reduction in violations, due to any cause, means a later decrease in accidents. Our records show a decrease of 10.4% in driving violations for one year with a corresponding reduction in accidents of 9.2%.

   The Town of Charlton, on Route 20, at "Richardson's Corner" showed an increase in driving violations, in one year, of 130% with a resulting increase in accidents of 100%.

   At Easton ½ mile south of the north junction of Routes 123 and 138, an increase in driving violations of 67% occurred in one year, with an increase in accidents of 200%.

5. An increase in the volume of traffic at a given point does not carry a proportionate increase in accidents. It works the other way, i.e., as the volume of traffic increases the ratio of accidents to volume decreases.

6. For any given period pedestrians show a higher percentage of violations at traffic lights than the drivers showed for any of the five types of studies made of the latter's behavior.

7. Speed characteristics at any given location remain constant, for all practical purposes, from day to day, except when affected by a heavy volume of traffic or by unusual conditions due to weather. A comprehensive speed study, once made, can serve as a guide for enforcement officers until some pronounced change at the site alters its characteristics.

8. The human equation, i.e., the driver, is at fault most of the time. Weather, road conditions, car condition, time element, etc., apparently have little to do with the accident and behavior record.

9. We have better roads and better vehicles - we still need better drivers.

10. Accidents and violations are fewer in bad weather and on slippery roads because the driver is taking less chances under these conditions.

Driving Violations

Our records show a steady reduction in certain types of driving violations, but "Speed Too Fast for Conditions" and "Failure to Keep to the Right of the Center Line" are not showing improvement and should be the object of more enforcement by the proper enforcement officials.

Speed in many cases exceeds speed limits, engineering limits, and also the physical limits of the driver to control his car.

Failure to keep right involves many vehicles in accidents when passing other cars and in the preparation for right turns. It is serious to the extent that it inflicts dangerous conditions on other drivers, and with present speeds and density of traffic it is a prolific source of serious accidents. Related to this is the failure of many drivers to be on the left of traffic when about to make left turns, instead of making such a turn from the right of traffic.

Drunken Driving

This is, undoubtedly, the cause of many of the driving violations. Its treatment is a subject far beyond the scope of this project, other than its appearance as a cause in the accident records. Last year over 6% of the accidents involved drunken driving. In fatal accidents the percentage was about double this figure.

Pedestrian Behavior

Our records show pedestrians to be worse violators than are drivers. Drivers' violations of traffic lights is 2% over a three year period; that of the pedestrian is over 44% for the same period. When 44% of the pedestrians violate the traffic lights there is something radically wrong. The peak of pedestrian violation comes between 5 and 6 PM, at the same time that automobile traffic is the heaviest and drivers in the greatest hurry. Bad as the pedestrian appears from our

Pedestrian Behavior - Cont'd.

proven data, he is known to be even worse. This project studied the pedestrian at those points only where he was supposed to cross the highway. Consider his record elsewhere.

Stop Sign Obedience

Our records show that stop sign violations are the highest of any type of traffic regulations. The thing that prevents the accident record from being high at these locations is the fact that 50% of the cars enter the intersection at less than 5 miles per hour, at which speed the cars are usually under complete control.

Bicycle Accidents

One of our gravest problems is the bicycle riders. Fatalities and injuries show a big increase year by year for the past three years in automobile accidents that involve bicycles.

****

The year 1937 saw an improvement in cars and highways, as well as a better quality of law enforcement. The driver and the pedestrian did not improve in the same ratio.

Most of our accidents occur on dry roads, in clear weather, and on the straightaways where the driver is going straight ahead and where he can and does "step on the gas." This proves conclusively the major part that speed plays in our automobile accidents.

There has been no attempt in this report to suggest remedies for the present traffic situation. We have ideas of course on every angle, but it is our prescribed job to point out existing conditions as the figures show them, and leave the remedy to the proper enforcement officials.

We feel that the whole situation can be summarized in the following words taken from the Travelers News Bureau - "Millions of words have been written and spoken during the past year about the causes of America's tragic automobile accident problem. Boiled down they amount to this -

TOO MUCH SPEED; TOO LITTLE COURTESY."

SECTION THREE

OF THE REPORT OF

THE HIGHWAY TRAFFIC RESEARCH

COVERING ITS

EXHIBITS

JUNE 1936 to DECEMBER 1937

I SELECTION OF EXHIBITS

The exhibits in Section Three are selected from the accumulation developed during the life of this project. The number could be considerably increased but those selected, and herewith presented, represent only those items now used because adopted after they had been found satisfactory following thorough trial and revision over a considerable period. In many cases they have been reduced in size to avoid the folding required with a full-size exhibit.

II NATURE AND ARRANGEMENT OF EXHIBITS

In the following pages the exhibits are so grouped that they follow substantially the same order as the previous divisions of the report, thus lending themselves to reference to the texts with which they belong.

Exhibits, though arranged in groups, are numbered in sequence - in this form (0) - beginning with Section Three and bearing no relation to the previous sections which are, of themselves, complete units.

III DESCRIPTION OF EXHIBITS

No. 1 Organization Chart

Indicating the relative simplicity of the organization required and of its various contacts with outside connections.

No. 2 Traffic Regulations of Cities and Towns

A listing of the many traffic regulations of towns and cities in Massachusetts compared with a traffic code proposed by the Massachusetts Department of Public Works. Inserted to indicate the complexity of such laws but, more particularly, the over-lapping of authority and part of the reason for the lack of co-ordinated activity.

No. 3 Accident Spot Map - Massachusetts - 1935

Showing accidents occurring on the State and Numbered Routes in Massachusetts in 1935 - excepting in Boston, Worcester and Springfield. Only the central and western portions of the State are shown. The entire map contained nearly 12,000 pins. Similar procedure was followed in 1936 and 1937.

No. 4 Accident Table By One-Mile Blocks - General Use

Indicating the method by which the accidents occurring in one mile stretches are used as a basis for patrolling such stretches by State Police.

No. 5 Basic Strip Maps - Preparation and Reproduction

Detail of sources of data, its preparation, mapping, revision and issue, as a foundation for the display of various forms of data developed by the project.

No. 6 Basic Strip Maps - Original Foundation Map

A typical strip map of a portion of a route covering two towns with code numbers of studied sites, mileage distances and detail of intersecting roads and routes and of hazards.

No. 7 Basic Strip Map - Accident Spot Map

Indicating how the basic strip is used to portray accident spots, together with tabulation of town records and mile blocks.

No. 8 Basic Strip Map - Highway Speed Studies

Method of displaying the record of volume and speeds of vehicles as taken by the Mobile Crew.

No. 9 Condition Diagram

A typical map made of a coded site which has been studied. Used by State Police in checking accident reports and as a means for answering any questions that may arise concerning data covering behavior at such sites when such data is being worked up in office or when such a site is up for special study as a hazardous location.

No. 10 Location Sheet

Contains the basic information given by a supervisor to a field crew as a basis for its studies. To it are clipped the forms for recording data of the observations required. It is a "job order". A copy returned to the Boston office serves as an indication of work being done in field and when results of such work will be available.

Nos. 11 to 19 Field Study - Tally Sheets

Showing the several forms now in use by field crews for the purpose of recording the violations and behavior of drivers at the actual location in the field. This data is returned, with the Location Sheet (10 above) to the Computing Division and is worked up and summarized on the following forms.

Nos. 20 to 26 Field Study - Summary Sheets

Showing the manner in which the data secured in the field is tabulated and summarized in condensed form before being sent to the Analysis Division.

Nos. 27 and 28 Field Study - Office Records

Illustrates the headings of the office forms found essential to record work done. Used only as office records at the central office and by field supervisors.

Nos. 29 to 34 Correlation Summaries of Field Studies

These forms are used to bring together the results of all behavior and violation records for the purpose of comparing them, by different troop areas, towns or for the State, with accident records for the same areas.

This information when arranged and interpreted, in connection with the Accident Reporting form (35 below), results in bringing cause and effect under scrutiny and forms the basis for many of our activities.

No. 35 Accident Reporting Form

Used in compiling records of accidents from local police records in order to make the facts available for the work of the project. The data of accidents reported by the State Police is also summarized on this form.

No. 36 to 41 Quarterly Report of Accidents

A typical report, as issued quarterly, showing accidents on State and Numbered Highways of Massachusetts consists of accidents reported by State Police, by local police and a combination of both.

Information of this nature is issued and tabulated in many forms for various purposes and groups as required. The tables in Section Two of this report are of the same general nature and for like use.

No. 42 to 44 Mobile Speed Crew Study Forms

Show the field tally sheets and the office work and summary sheets for records of traffic speeds.

No. 45 Speed Crew - Road Unit

An illustration showing a field speed recording unit set up on the road with trips in place. Usually the recorder's vehicle is kept reasonably out of sight or well off the traveled way.

No. 46 Electric Speed Detector - Interior

Shows the general arrangement of the interior of the unit as now constructed and used. This instrument was built by men formerly connected with this project.

No. 47 Electric Speed Detector - Dial Faces

Gives an illustration of the dial top of the instrument and some idea of its size. The weight is about forty pounds.

No. 48 Electric Speed Detector - Trip Construction

Detail of manner of constructing trips as used in Electric Speed Detector.

No. 49 Hughes' Speed-scope

A device used for establishing the length of a temporary road trap for use on Short Speed studies or, with hand contactors in place of road trips, for use when regular trips of electric speed recorder become short-circuited.

Nos. 50 to 53 Hazardous Location Study - Typical

Showing the data and recommendation sheets, in graphic form, of a typical study made of a congested area of a hazardous nature on one of the principal routes in the State.

ORGANIZATION CHART

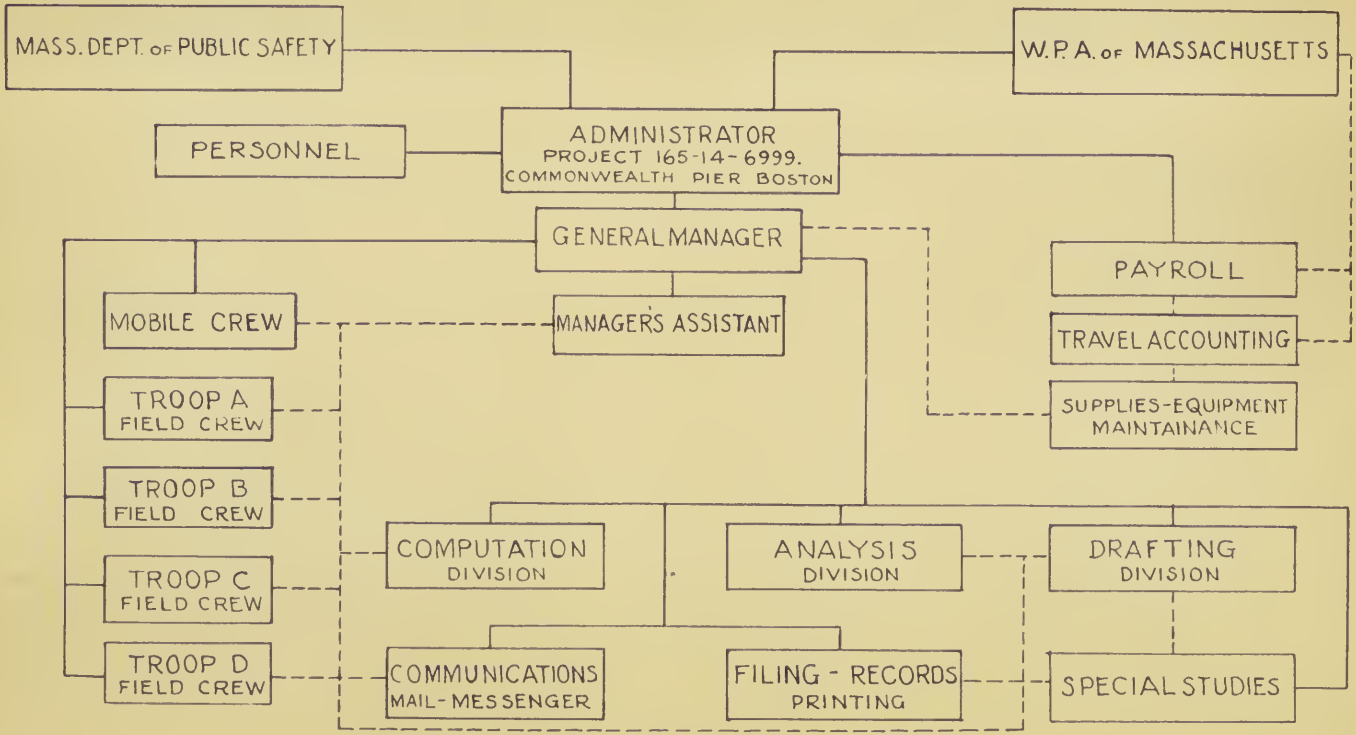
HIGHWAY TRAFFIC RESEARCH

WPA PROJECT 165-14-6999.

MASSACHUSETTS DEPARTMENT OF PUBLIC SAFETY

COMMONWEALTH PIER, BOSTON

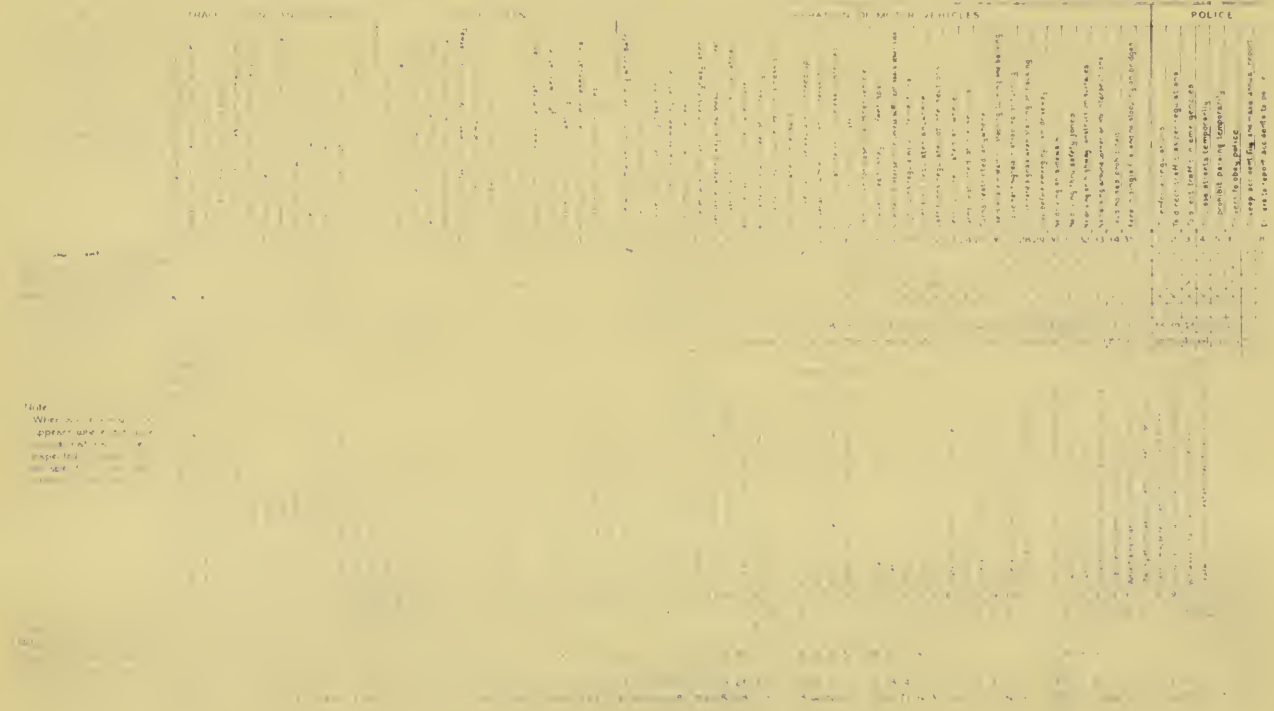
EFFECTIVE JUNE 1936

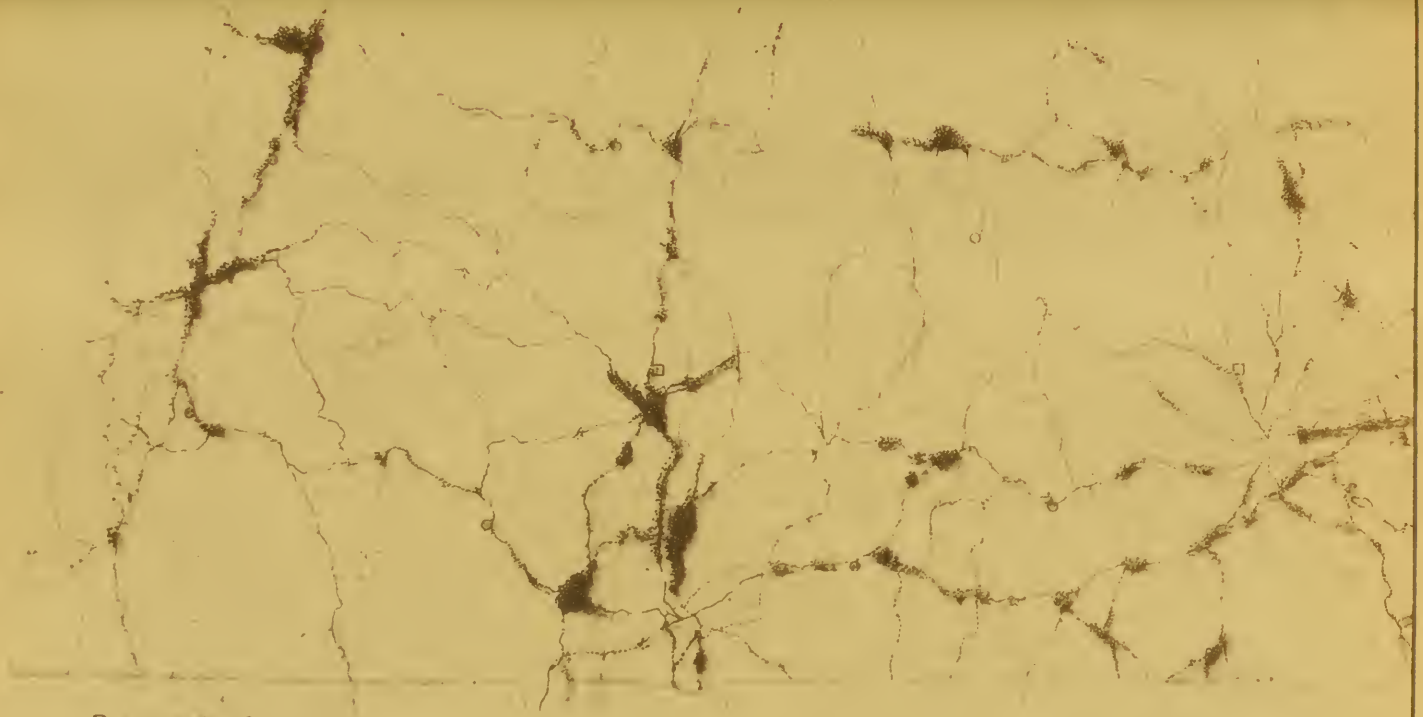


——— Organization Sequence

----- Permissable Contacts

TRAFFIC REGULATIONS OF CITIES AND TOWNS OF MASSACHUSETTS COMPARED WITH PROPOSED TRAFFIC CODE





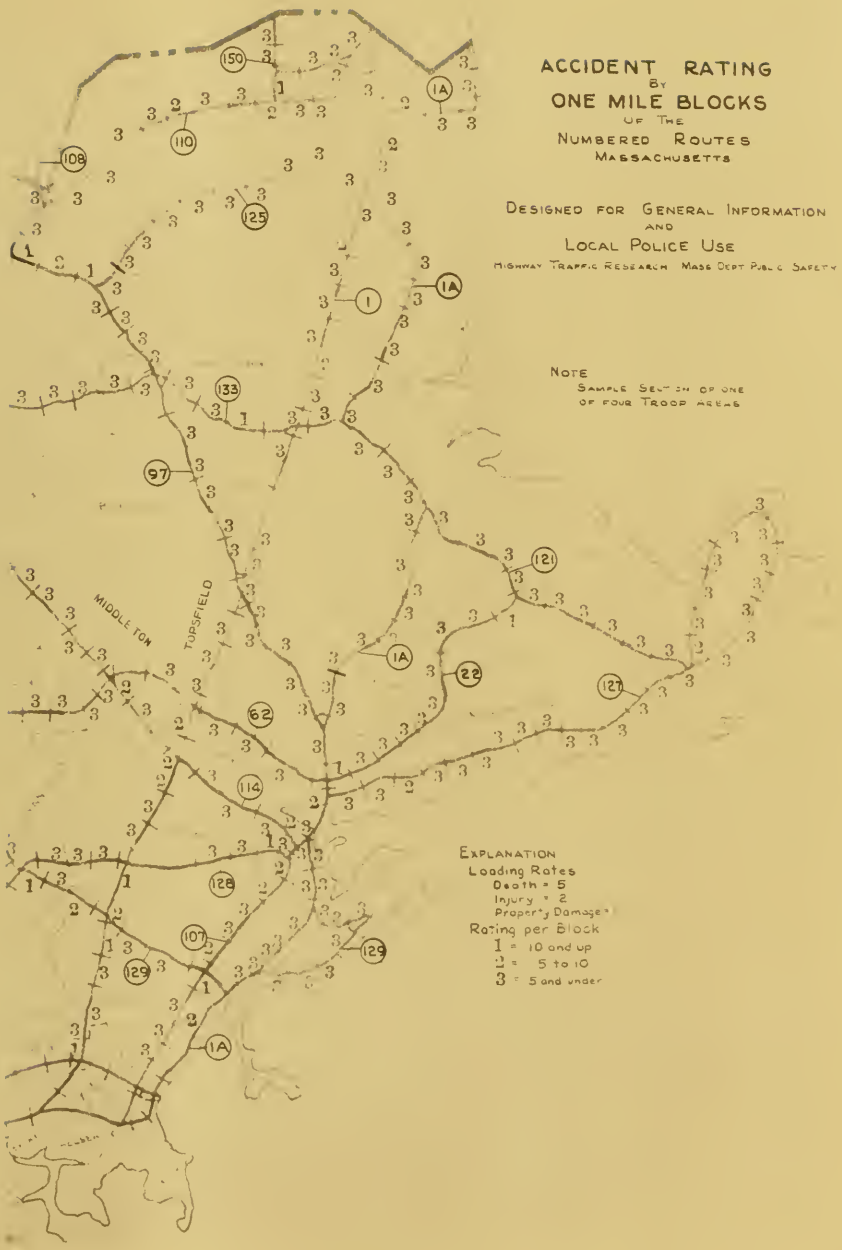
PORTION OF STATE ONLY

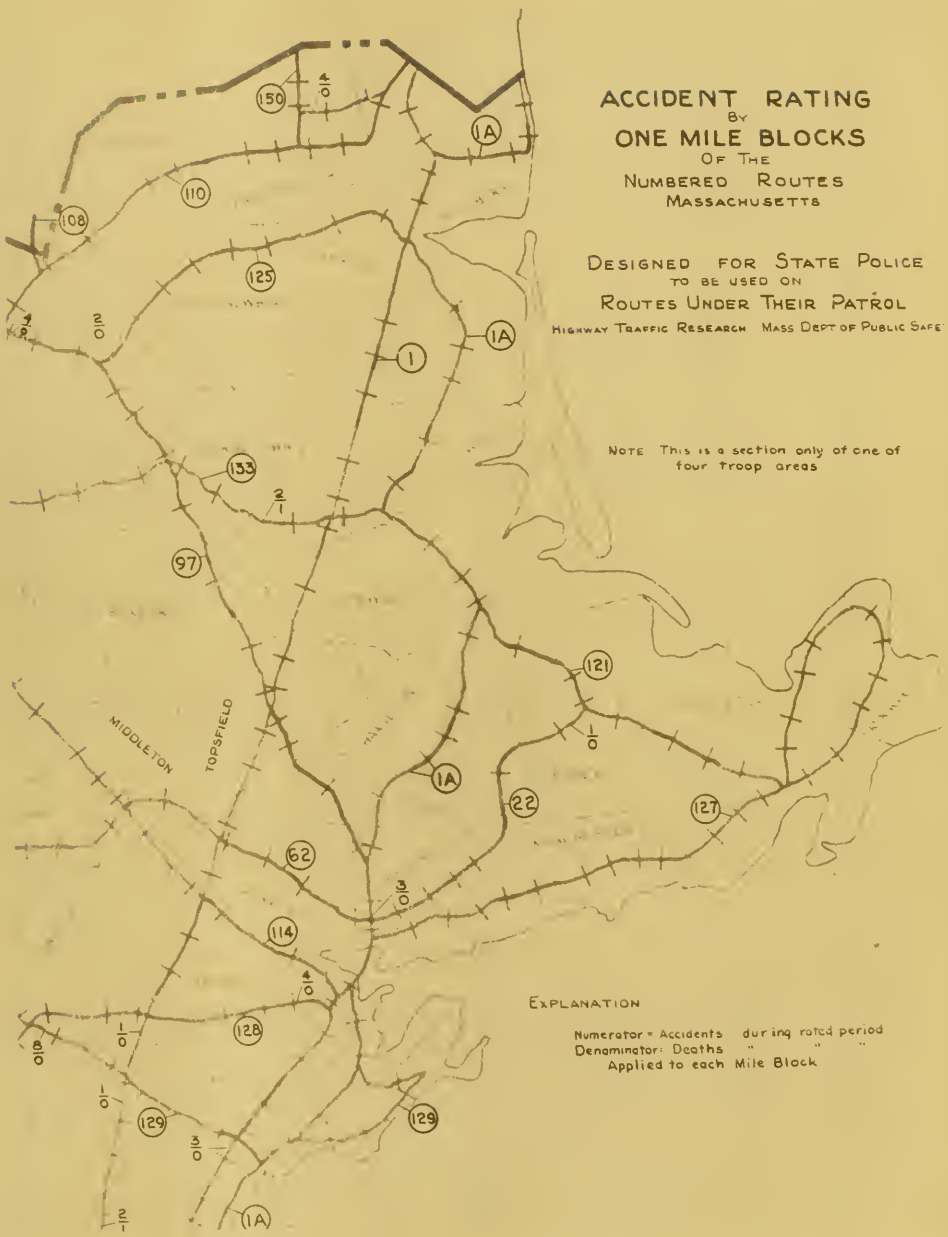
COMMONWEALTH MASSACHUSETTS

ACCIDENT SPOT MAP

PRINCIPAL HIGHWAYS

1935


ACCIDENT RATING
BY
ONE MILE BLOCKS
OF THE
NUMBERED ROUTES
MASSACHUSETTS
DESIGNED FOR GENERAL INFORMATION
AND
LOCAL POLICE USE
HIGHWAY TRAFFIC RESEARCH MASS DEPT PUBLIC SAFETY
NOTE
SAMPLE SECTION OF ONE
OF FOUR TROOP AREAS
MIDDLE TOWN
TOPSFIELD
EXPLANATION
Loading Rates
Death = 5
Injury = 2
Property Damage = 1
Rating per Block
1 = 10 and up
2 = 5 to 10
3 = 5 and under


ACCIDENT RATING
By
ONE MILE BLOCKS
Of The
Numbered Routes
Massachusetts
Designed for State Police
to be used on
Routes Under Their Patrol
Highway Traffic Research Mass Dept of Public Safe
Note This is a section only of one of four troop areas
Explanation
Numerator = Accidents during rated period
Denaminator: Deaths " " "
Applied to each Mile Block
MIDDLETON
TOPSFIELD
150
108
110
125
1
133
97
62
114
128
129
121
22
127
1A

PREPARATION & REPRODUCTION OF BASIC STRIP MAPS
AND OF A SERIES OF
SECONDARY STRIP MAPS, BEARING SUPPLEMENTARY DATA

INCLUDING CODED SITE MAPS & HIGHWAY SPEED BREAKDOWN
FOR NUMBERED ROUTES IN MASSACHUSETTS

STEPS FROM THE DISTRIBUTION OF SUCH MAPS & DATA TO THE ULTIMATE USER

1 FIRST DRAFT for BASIC STRIP

PREPARED - By drafting [illegible]
CRAWN - [illegible]
SCALE - Two inches to the mile
BASED - On state county [illegible] other routes. Subject to [illegible] Discriminating [illegible]
DELIVERED - To Field Crews for revision

2 FIELD REVISIONS

REVISIONS - By field crews of troop areas
DATA - Actual roads traveled with mass. Corrections made [illegible]
MILEAGES - Based on odometer readings. Read north to south, first east to west from route origin
DELIVERED - To drafting room for inking

3 PRIMARY BASIC STRIP

PREPARED - By [illegible]
BASED - On [illegible] received by field crews. Revised [illegible]
FIELD MILEAGES - [illegible] office data and final form [illegible]
SITE CODES - Code numbered studied sites added at exact locations
DATED - Map carries date of [illegible]
IDENTIFICATIONS - [illegible] by:
(a) Date of issue on the
(b) Title in area with the
(c) Sheet number in the area
(d) Panel number assigned serially from route origin N to S and from E to W [illegible] (See 4A)
DELIVERED - For secondary preparation

4 SECONDARY BASIC STRIP

MAP CONTROL DIVISION

(A) PANEL & NUMBER IDENTIFICATION
Panel Number - Route number followed by serial number not duplicated on any other panel. Begins route from east end and continues through area lines. For ordering prints only. Added by Map Control Division

(B) BASIC NEGATIVE - Corrected [illegible] with [illegible] prepared, as needed, [illegible] for

(C) BASIC BLUEPRINTS - from Master [illegible]
HEAVY PRINTS - For route
One set Maps Offices, Reference
One set Analysis Division Basis for [illegible] Mile Work Sheet
THIN PRINTS - Route portions [illegible] set of entire route to Analysis Division for Accident Spot Maps
One partial set to Mail & Files for locating sites and tabulating [illegible] data at [illegible] [illegible] for speeds
One partial set to Reporting and Speed Unit for charting [illegible] to be posted on portion of route studied

(D) FILING OF SCRIPTS AND NEGATIVES
In Map Control Room
for reuse for printing
All original Primary Strips
All Thin Weight Panels
All Thin [illegible] Panels bearing complete mileage, title
All Coded Site Positive Tracings
All Route Speed Breakdown Summaries

5 AMPLIFIED SECONDARY STRIPS

MAP CONTROL DIVISION [illegible]

(1) HEAVY PRINTS - [illegible] to Maps & Offices for general reference by Analysis [illegible] for marking to be [illegible] [illegible] density segregation

(2) THIN PRINTS - [illegible]
(a) Analysis - One set complete strips [illegible] Local Police accidents recorded for year [illegible] Partial strips if [illegible] Traffic events studied. Show [illegible] and [illegible] and peaks & minimums of Average and Maximum speeds
(b) [illegible] Speed Studies
Copy of [illegible] for [illegible] Speeds have been prepared to be posted

(3) INKING, TITLING & LABELING
All work under [illegible]
All work required [illegible] inked by the Drafting Division in colors proper titles and letter following Panel Number to identify each type of work for printing

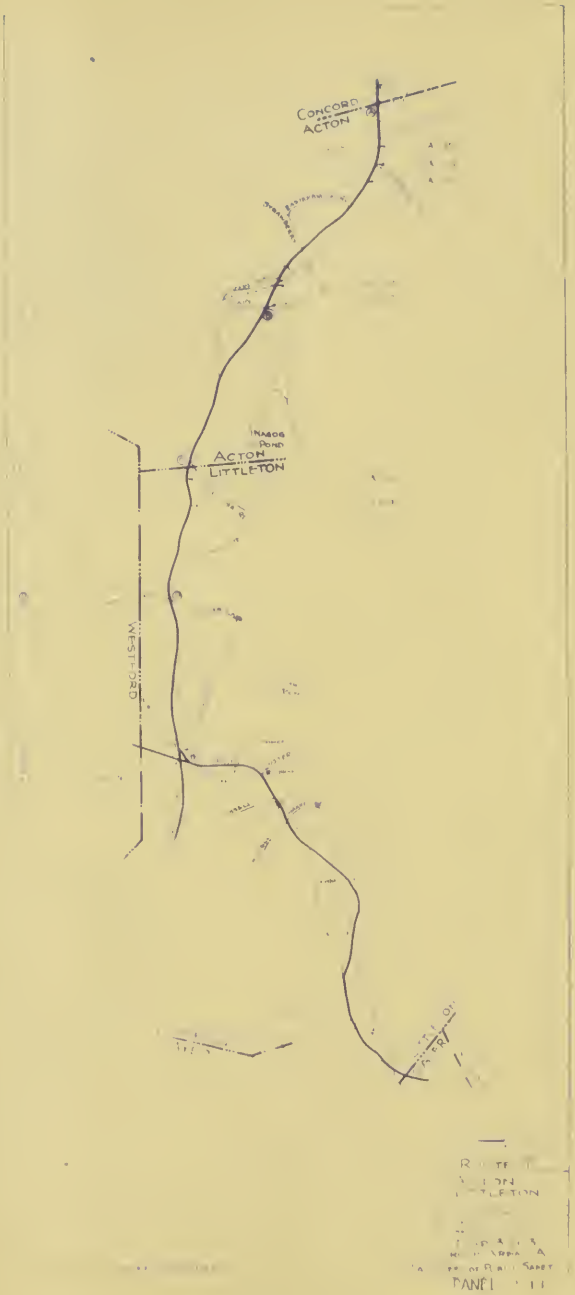
(4) DISTRIBUTION OF BASIC & AMPLIFIED STRIPS - When and as determined by Department of Public Safety and Others. To follow distribution schedule as determined from time to time.
Filing copies [illegible]

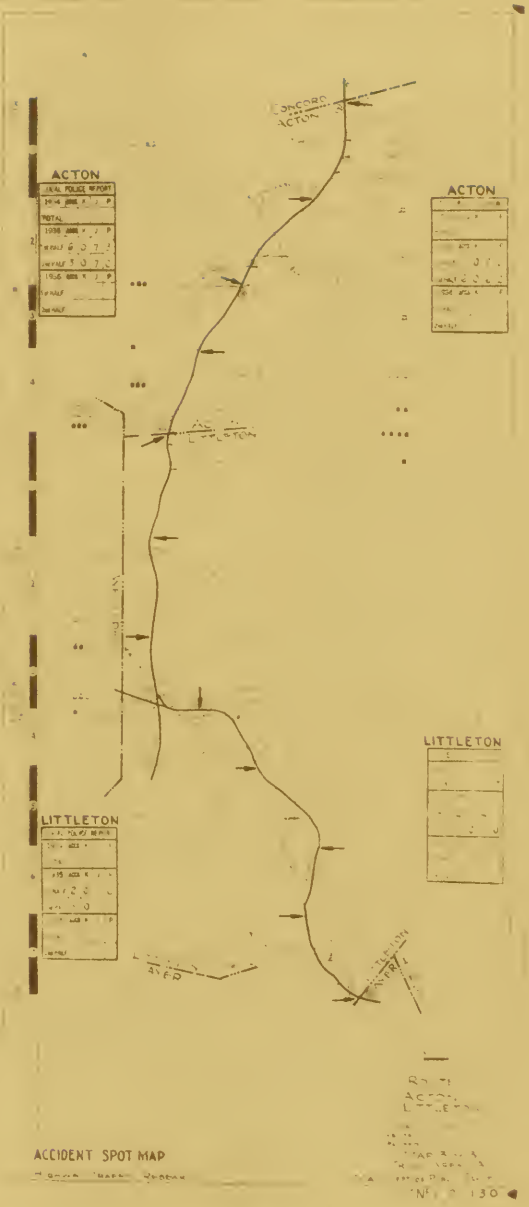
6 [illegible]

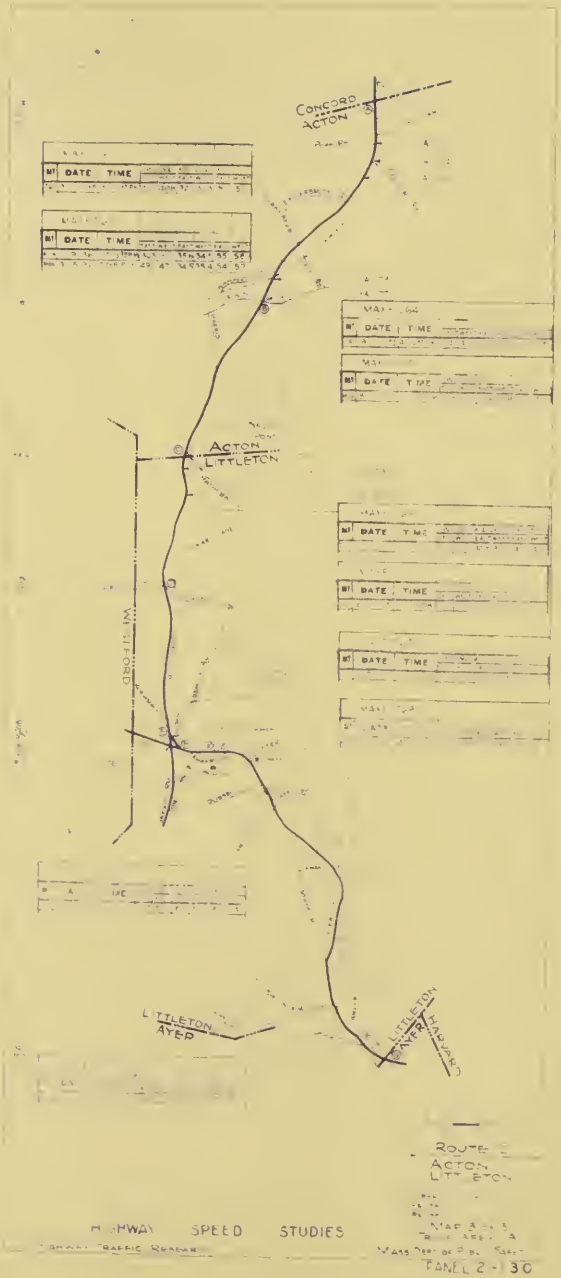
PREPARED - [illegible]
Base Strip
IDENTIFICATION NUMBERS
[illegible]
PRINTED - [illegible]
[illegible]
DISTRIBUTED - [illegible]
One complete [illegible]
[illegible]
One [illegible]
[illegible]
BOUND - [illegible]
FILED - [illegible]

7 ROUTE SPEED BREAKDOWN

RECORD - [illegible]
TABULATED - [illegible]
ENTERED - [illegible]
PRINTED - [illegible]
One [illegible]
BOUND - [illegible]
(520) as reference [illegible]
FILED - [illegible]


CONCORD
ACTON
ACTON
LITTLETON
WESTFORD


ACTON
ACTON
LITTLETON
LITTLETON
ACCIDENT SPOT MAP


CONCORD
ACTON
ACTON
LITTLETON
WILLIAMS
LITTLETON
AYER
LITTLETON
AYER
HARVARD
ROUTE 2
ACTON
LITTLETON
HIGHWAY SPEED STUDIES
PANEL 2 - 30

HAZARD: INTERSECTION

LOCATION: RTE 28 AT BANK ST 2.7 MI. E. OF DENNIS LINE

D1167

HARWICH

LOCATION SHE

MILES FROM

THIS SECTION TAKEN AT

INTERSECTION [ ] ROUTE NO OR NAME OF STREET

CURVE

[illegible] STREET

STRAIGHTAWAY

DRUG TRAVEL STUDIES AT ALCHE

NORTH	D	H	L	C	P	S	T	V	
SOUTH	D	H	L	C	P	S	T	V	
EAST	D	H	L	C	P	S	T	V	
WEST	D	H	L	C	P	S	T	V	
	D	H	L	C	P	S	T	V	

APPROX NORTH

SINGLE LINE SKETCH

JACOBS COR

SAMPLE SKETCH

GIVE BOTH ROUTE NO AND LOCAL STREET NAME WHEN KNOWN

NO ATE ASSUMED FOR ECTION OF TRAFFIC BY NSERTING N S E or W N CIRCLES

GIVE CHARACTERISTIC OR LOCAL NAME FOR CATION

TOTAL INTERSECTIONS & CORRESPONDING DIRECTIONAL TRAFFIC MOVEMENTS
L = LEFT TURN
S = STRAIGHT
R = RIGHT TURN

B			L	S	R
A	C				R
					R
	D			L	R
					R
A	B				
	C				R
		A			
			B	L	R
	C				R
	A	B			
			B		R
			C	S	R
A	B				R
			B		R
	C				

WEATHER

PAVEMENT CONDITION

TAKE THIS STUDY WITH D-P-T STUDIES ONLY

VEHICULAR VOLUME

CODE - V

LOCATION - RT AT

MILES FROM

TOWN

DATE 193

DAY SUN. MON. TUE. WE THU. FRI SAT.

TIME M TO M

OBSERVER

WEATHER FAIR ☐ RAIN ☐ CLOUDY ☐ SNOW ☐ FOG ☐

THIS STUDY TAKEN AT		ROUTE NO OR NAME OF STREET	DIR. OF TRAVEL	PAVEMENT CODE	REMARKS
INTERSECTION	☐		NORTH		
CURVE	☐		SOUTH		
HILLCREST	☐		EAST		
STRAIGHTAWAY	☐		WEST		
	☐				

SUPERVISOR TO FILL OUT THIS SECTION ON FIRST SHEET ONLY

L	STRAIGHT	R

TRAFFIC NORTH BOUND

L	STRAIGHT	R

TRAFFIC SOUTH BOUND

L	STRAIGHT	R

TRAFFIC EAST BOUND

L	STRAIGHT	R

TRAFFIC WEST BOUND

AGT

MASS. DEPT. PUBLIC SAFETY - HIGHWAY TRAFFIC RESEARCH

TAKE ONE JOB N
COUNT WITH THIS SHEET

DRIVING OBSERVATIONS

LOCATION R F AT

MILE

THIS STUDY INCLUDES
INTERSECTION
CURV
HILLCREST
STRAIGHTAWAY

ROUTE NO. OR NAME OF STREET

DIRECTION OF TRAVEL	PAVEMENT CODE	PAINT LINES
NORTH	___ ___	GOOD ☐ POOR ☐ NONE ☐
SOUTH	___ ___	GOOD ☐ POOR ☐ NONE ☐
EAST	___ ___	GOOD ☐ POOR ☐ NONE ☐
WEST	___ ___	GOOD ☐ POOR ☐ NONE ☐
___	___ ___	GOOD ☐ POOR ☐ NONE ☐

ILLUMINATION DAYLIGHT ☐ GOOD ☐ POOR ☐ NONE ☐ REGION RURAL ☐ RES. ☐ BUS ☐

SUPERVISOR TO FILL OUT THIS SECTION ON FIRST SHEET ONLY

CODE
TOWN
DATE 193
DA SUN MON TUES WED THU FRI SAT
TIME M TO M
OBSERVER

WEATHER FAIR ☐ RAIN ☐ FOG ☐ CLOUDY ☐

PAVEMENT CONDITION
DRY ☐ WET ☐ ICY ☐ SNOW ☐

FILL OUT ON EACH SHEET

TURNING FROM WRONG LANE		FAILING TO KEEP RIGHT		ON LEFT OF CENTERLINE AT HAZARD OR NO TRAFFIC NEAR	EXCESSIVE SPEED	PASSING AT HAZARD	HAZARDOUS U TURN	FOLLOWING TOO CLOSELY	CUTTING IN TOO CLOSE	CUTTING OUT WITH CAR COMING	PASSING TO RIGHT RECKLESSLY
LEFT	RIGHT	CAR COMING OPP DIRECT	CAR BEHIND TRIES TO PASS								

HIGHWAY TRAFFIC RESEARCH - DEPT PUBLIC SAFETY

TARGET ISOLATE
VOLUME WITHIN SCHED
INTERSECTION RTE AT

DRIVING & TRAFFIC SIGNAL CHARACTERISTICS STUDY

ITEM NO. NAME OF STREET

DIR OF TRAVEL	MILES PER HR	LIGHTS USED AND CHECK BELOW	RED / GREEN TIME	PAVEMENT CODE
NORTH	R & A	UR →		
SOUTH	R & A	GR →		
EAST	R & A	GR →		
WEST	R & A	GR →		
	R & A	GR →		

PAINT LINES
GOOD ☐ POOR ☐ NONE ☐
GOOD ☐ POOR ☐ NONE ☐
GOOD ☐ POOR ☐ NONE ☐
GOOD ☐ POOR ☐ NONE ☐
GOOD ☐ POOR ☐ NONE ☐

TYPE OF SIGNAL CONTROL PRETIMED ☐ SEMI ACTUATED ☐ FULLY ACTUATED ☐ PEDESTRIAN BUTTON ☐
ILLUMINATION DAYLIGHT ☐ GOOD ☐ POOR ☐ NONE ☐ REGION RURAL ☐ RES ☐ BUS ☐

CODE TIME
TOWN
DATE
DAY SUN MON TUE WED THU FRI SAT
TIME M TO
OBSERVER
WEATHER FAIR ☐ RAIN ☐ CLOUDY ☐ SNOW ☐ FOG ☐
PAVEMENT CONDITION
DRY ☐ WET ☐ ICE ☐ SNOW ☐

LEFT	STRAIGHT	RIGHT
ENTERS FACING RED		
ENTERS FACING RED & AMB		
CAUGHT ON RED		
STARTED TOO EARLY		
OVER RAN STOP LINE		
TURNING FROM WRONG LANE		
ON LEFT OF CENTER LINE		
EXCESSIVE SPEED		
PASSING TO RIGHT (RECKLESS)		

NORTH BOUND

LEFT	STRAIGHT	RIGHT
ENTERS FACING RED		
ENTERS FACING RED & AMB		
CAUGHT ON RED		
STARTED TOO EARLY		
OVER RAN STOP LINE		
TURNING FROM WRONG LANE		
ON LEFT OF CENTER LINE		
EXCESSIVE SPEED		
PASSING TO RIGHT (RECKLESS)		

SOUTH BOUND

LEFT	STRAIGHT	RIGHT
ENTERS FACING RED		
ENTERS FACING RED & AMB		
CAUGHT ON RED		
STARTED TOO EARLY		
OVER RAN STOP LINE		
TURNING FROM WRONG LANE		
ON LEFT OF CENTER LINE		
EXCESSIVE SPEED		
PASSING TO RIGHT (RECKLESS)		

EAST BOUND

LEFT	STRAIGHT	RIGHT
ENTERS FACING RED		
ENTERS FACING RED & AMB		
CAUGHT ON RED		
STARTED TOO EARLY		
OVER RAN STOP LINE		
TURNING FROM WRONG LANE		
ON LEFT OF CENTER LINE		
EXCESSIVE SPEED		
PASSING TO RIGHT (RECKLESS)		

WEST BOUND

TAKE VEHICLE AND PEDESTRIAN COUNTS WITH TWO SHEETS

PEDESTRIAN VIOLATIONS 470

CODE [ ] [ ] [ ]

LOCATION - ST _____ & _____

_____ MILES _____

TOWN _____

DATE _____ 93

DAY SUN MON TUES WED THURS FRI SAT

TIME _____ M TO _____ M

OBSERVER _____

RED & AMBER PEDESTRIAN PERIOD — YES ☐ NO ☐

MANUAL CONTROLLED SIGNALS
FROM _____ M TO _____ M
_____ M TO _____ M

TYPE OF SIGNAL CONTROL — PRE-TIMED ☐ SEMI-ACTUATED ☐ FULLY-ACTUATED ☐ PEDESTRIAN ☐

SUPERVISOR TO FILL OUT THIS SECTION ON FIRST SHEET ONLY

TIME	RED & AMBER	WITH GREEN	AGAINST RED	DIAGONAL ON OTHER THAN R & H PER
_ TO _ MO				
_ TO _ MO				
_ TO _ MO				
_ TO _ MO				

THIS SPACE RESERVED FOR BOSTON OFFICE USE ONLY

MASS. DEPT. OF PUBLIC SAFETY — HIGHWAY TRAFFIC RESEARCH

468

STOP SIGN OBSERVANCE

FLASHING RED LIGHT YES ☐ NO ☐

LOCATION - RT ___ AT _____

SIGN LOCATED ON

RT. _____ ST. | ___ MILES | DIR OF TRAVEL N S E W | PAVEMENT CODE ___

ILLUMINATION: DAYLIGHT ☐ GOOD ☐ POOR ☐ NONE ☐

REGION: RURAL ☐ RES ☐ BUS ☐

FLASHING RED LIGHT FROM ___ M TO ___ M

SUPERVISOR TO FILL OUT THIS SECTION ON FIRST SHEET ONLY

WEATHER: FAIR ☐ RAIN ☐ FOG ☐ CLOUDY ☐ SNOW ☐

PAVEMENT CONDITION: DRY ☐ WET ☐ ICE ☐ SNOW ☐

CODE -S-

TOWN _____

DATE _____ 193__

DAY SUN MON TUE WED THU FRI SAT

TIME ___ M TO ___ M

OBSERVER _____

TIME	MADE FULL STOP		FAILED TO STOP	
	NO INTERFERENCE	INTERFERENCE	NO INTERFERENCE	INTERFERENCE
-0 M TO -0 M				
-0 M TO -0 M				
-0 M TO -0 M				
-0 M TO -0 M				

USERS MUST NOT FOLD

MASS. DEPT. PUBLIC SAFETY - HIGHWAY TRAFFIC REASEARCH

230 SPEED STUDIES STR ☐ APP THRU ☐

CODE 10

LOCATION-RT

TYPE OF HAZARD
INTERSECTION ☐
CURVE ☐
HILLCREST ☐

MILES FROM

DIRECTION OF TRAVEL
N S E W ON RT

PAVEMENT CODE

THIS STUDY GOES WITH
APPROACH STUDIES 1 2 3 4
THRU STUDIES 1 2 3 4

WEATHER FAIR ☐ RAIN ☐ FOG ☐ CLOUD ☐ SNOW ☐

PAVEMENT CONDITION DRY ☐ WET ☐ ICE ☐ SNOW ☐

TOWN

DATE

DAY SUN MON TUES WED THUR FRI SAT

TIME M TO M

OBSERVER

SEC	TALLY	MPH	No	PROP	RANGE
LESS THAN 18					
18					
19		83.3			
20		79.0			
20		75.0			
1		71.4			
2		68.2			
3		65.2			
4		62.5			
5		60.0			
6		57.7			
7		55.6			
8		53.6			
9		51.7			
30		50.0			
1		48.4			
2		46.9			
3		45.5			
LEFT COL SUB TOTALS					

SEC	TALLY	MPH	No	PROP	RANGE
34		44.1			
5		42.9			
6		41.7			
7		40.5			
8		39.5			
9		38.5			
40		37.5			
1		36.6			
2		35.7			
3		34.9			
4		34.1			
5		33.3			
6		32.6			
7		31.9			
8		31.3			
9		30.6			
50		30.0			
MIDDLE COL. SUB TOTALS					

SKETCH OF HAZARD & DIMENSIONS OF TRAP LOCATED BELOW

SEC	TALLY	MPH	NO.	PROP	RANGE
51		29.4			
2		28.9			
3		28.3			
4		27.8			
5		27.3			
6		26.8			
7		26.3			
8		25.9			
9		25.4			
60		25.0			
62		24.2			
4		23.4			
6		22.7			
8		22.1			
70		21.4			
5		20.8			
80		19.8			
5		19.1			
90		18.7			
10.0		5.0			
MORE THAN 100					
RIGHT COL SUB TOTALS					
MIDDLE COL " "					
LEFT COL " "					
GRAND TOTALS					

NOTE FOR OBSERVERS

TALLY CARS GOING THRU TRAP IN LESS THAN 18 SEC AND MORE THAN 10.0 SEC. IN TALLY COL AS FOLLOWS:—
@ 18 - 2 @ 1.4 ETC
@ 10.8 - 1 @ 11.0 ETC

173

SPEED TALLY
ELECTRIC METER

EHO

LOCATION-RT .....AT .....MACHINE.....
DIRECTION.....HAZARD .....WEATHER.....OBSERVER. .....
PAVEMENT TYPE.....CONDITION.. ...LANES.. .LINES... .....RECORDER.....

CODE .....
TOWN .....
DATE ....DAY.....
TIME.....to... ....

MPH	TALLY	No.	Prod.	Rge
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
TOTAL				

MPH	TALLY	No	Prod.	Rge
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
TOTAL				

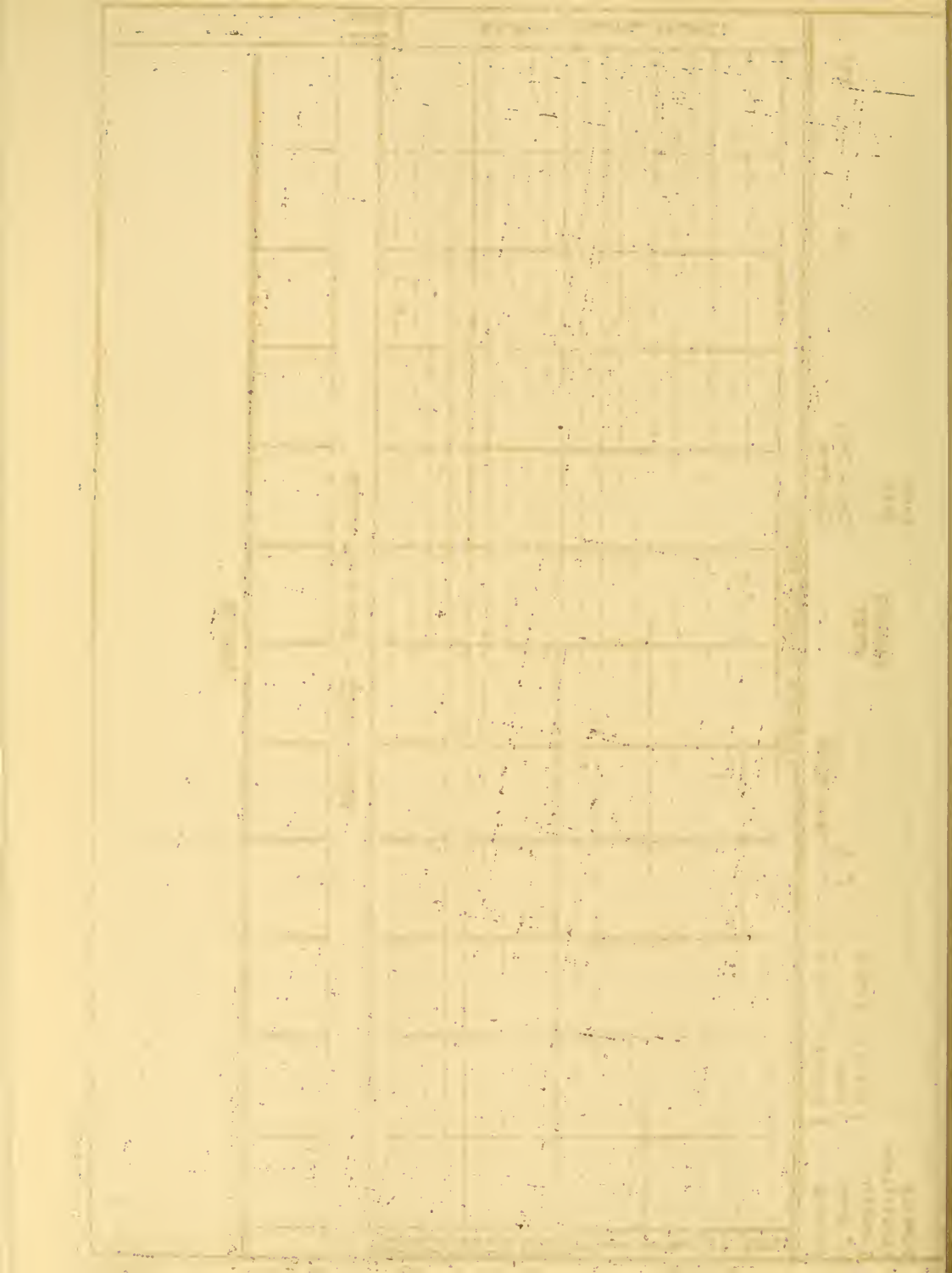
MPH	TALLY	No	Prod	Rge
55				
56				
57				
58				
59				
60				
61				
62				
63				
64				
65				
66				
67				
68				
69				
More than 69				
Rt. Col. Total				
Middle Col. Total				
Left Col. Total				
GRAND TOTAL				

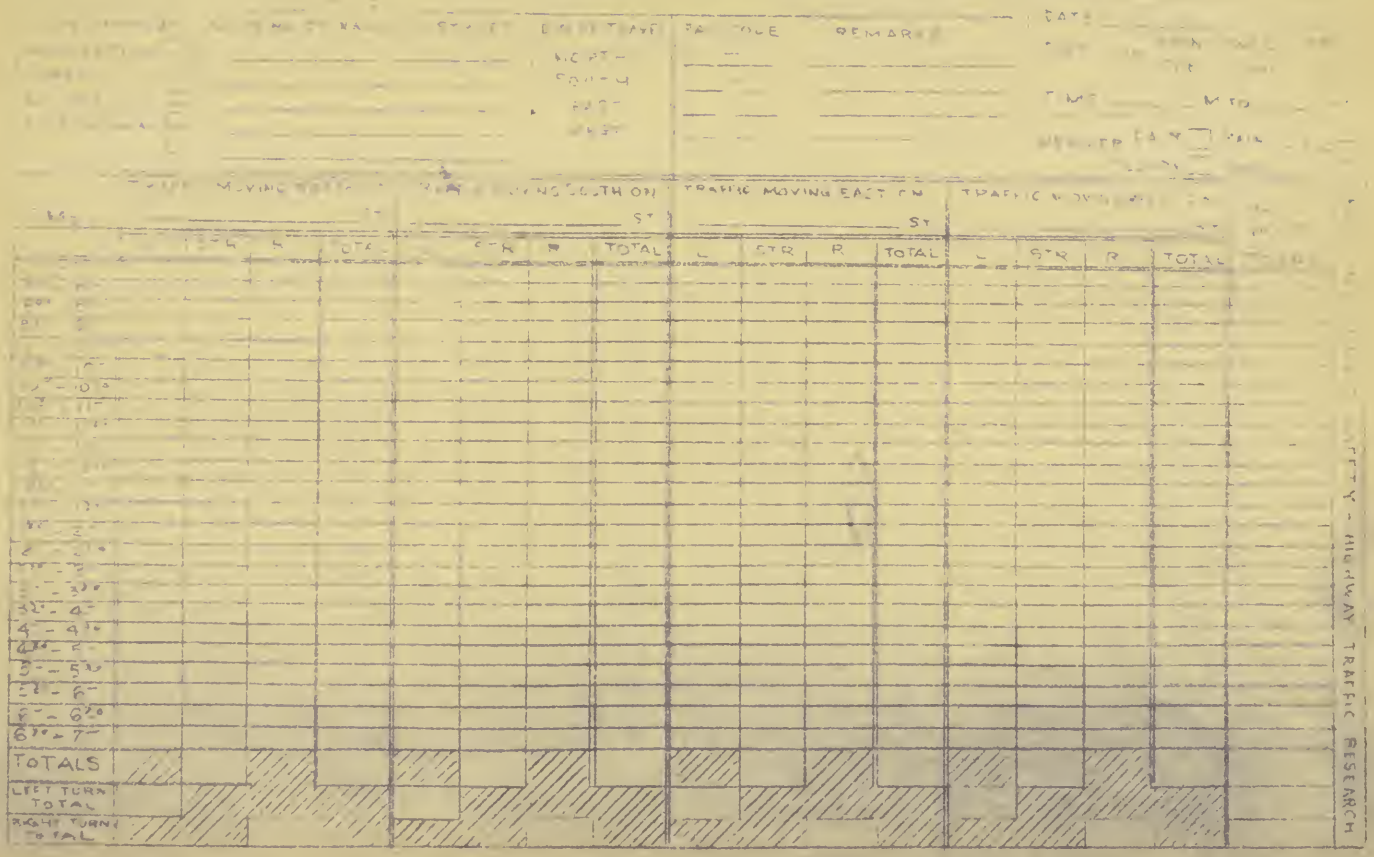
CARS PASSING OUT NOT CLOCKED

AVE. SPEED _____

MAX. SPEED _____

Highway Traffic Research




TRAFFIC MOVING SOUTH ON
TRAFFIC MOVING EAST ON
L
STR
R
TOTAL
TOTALS
LEFT TURN TOTAL
RIGHT TURN TOTAL
SAFETY - HIGHWAY TRAFFIC RESEARCH

ONE SUMMARY EACH DIRECTION

TRAFFIC SIGNAL VIOLATIONS - VEHICULAR - SUMMARY

CODE

LOCATION RT ___ AT _____

_____ MILES

TOWN _____

DATE _____ 193

DAY SUN MON TUE WED THU FRI SAT

TIME _____ M TO _____ M

WEATHER FAIR CLOUDY RAIN SNOW FOG

TRAFFIC MOVING ON RT _____ ST

PAVEMENT CODE _____

RED & AMBER YES ☐ NO ☐

DIR OF TRAVEL N S E W

MANUAL CONTROL FROM _____ M TO _____ M

GR ARROW ← ☐ ↑ ☐ → ☐

PAINT LINES GOOD ☐ POOR ☐ NONE ☐

TYPE OF CONTROL
PRE-TIMED ☐
SEMI-ACTUATED ☐
FULLY-ACTUATED ☐
PEDESTRIAN ☐

PAV COND
DRY ☐
WET ☐
ICE ☐
SNOW ☐

TIME	ENTERED FACING RED LIGHT				ENTERED FACING RED & AMBER LIGHT				CAUGHT ON RED LIGHT				STARTED TOO EARLY				OVER RAN STOP LINE	TOTALS	
	L	STR	R	TOTAL	L	STR	R	TOTAL	L	STR	R	TOTAL	L	STR	R	TOTAL		VIOLATION	VOLUME
7 - 7³⁰																			
7³⁰ - 8																			
8 - 8³⁰																			
8³⁰ - 9																			
9 - 9³⁰																			
9³⁰ - 10																			
10 - 10³⁰																			
10³⁰ - 11																			
11 - 11³⁰																			
11³⁰ - 12																			
12 - 12³⁰																			
12³⁰ - 1																			
1 - 1³⁰																			
1³⁰ - 2																			
2 - 2³⁰																			
2³⁰ - 3																			
3 - 3³⁰																			
3³⁰ - 4																			
4 - 4³⁰																			
4³⁰ - 5																			
5 - 5³⁰																			
5³⁰ - 6																			
6 - 6³⁰																			
6³⁰ - 7																			
TOTALS																			
% VOLUME																			

MASS. DEPT. PUBLIC SAFETY — HIGHWAY TRAFFIC BUREAU

ALL DIRECTIONS COMBINED

PEDESTRIAN VIOLATIONS SUMMARY

LOCATION RT. _____ AT _____

_____ MILES FROM _____

CODE - P -

TOWN _____

DATE _____ 193 ____

DAY SUN. MON. TUE. WED. THU. FRI. SAT.

TIME ____ M. TO ____ M.

STUDY TAKEN AT INTERSECTION ☐

_____ ☐

MANUAL CONTROL ☐ FROM _____ M TO _____ M

_____ M TO _____ M

TYPE OF CONTROL

PRE-TIMED ☐

SEMI-ACTUATED ☐

FULLY-ACTUATED ☐

PEDESTRIAN ☐

RED & AMBER YES ☐ NO ☐

TOTAL VEHICULAR VOLUME _____

WEATHER FAIR ☐ RAIN ☐ FOG ☐ CLOUDY ☐ SNOW ☐

TIME	RED & AMBER PEDESTRIAN PERIOD	WITH GREEN SIGNAL LIGHT	AGAINST RED SIGNAL LIGHT	DIAGONAL ON OTHER THAN R & A PERIOD	TOTALS
7 - 7 30					
7 30 - 8 -					
8 - 8 30					
8 30 - 9 -					
9 - 9 30					
9 30 - 10 -					
10 - 10 30					
10 30 - 11 -					
11 - 11 30					
11 30 - 12 -					
12 - 12 30					
12 30 - 1 -					
1 - 1 30					
1 30 - 2 -					
2 - 2 30					
2 30 - 3 -					
3 - 3 30					
3 30 - 4 -					
4 - 4 30					
4 30 - 5 -					
5 - 5 30					
5 30 - 6 -					
6 - 6 30					
6 30 - 7 -					
TOTALS					
% GRAND TOTAL					100.0

MASS. DEPT. PUBLIC SAFETY — HIGHWAY TRAFFIC RESEARCH

477

23

ONE SUMMARY EACH DIRECTION

STOP SIGN OBSERVANCE SUMMARY

478

LOCATION - RT _____ AT _____

_____ MILES

CODE - S -

TOWN _____

DATE _____ 193 ____

DAY SUN MON TUE. WED. THU. FRI SAT.

TIME _____ M TO _____ M

SIGN LOCATED ON RT. _____ ST.

DIRECTION OF TRAVEL N. S. E. W.

PAVEMENT CODE ___ - ___

FROM ____ M TO ____ M

FLASHING RED LIGHT YES ☐ NO ☐

TYPE INTERSECTION + ☐ T ☐ Y ☐

REGION RURAL ☐ RES. ☐ BUS. ☐

ILLUMINATION DAYLIGHT ☐ GOOD ☐ POOR ☐ NONE ☐

PAV. COND. DRY ☐ WET ☐ ICE ☐ SNOW ☐

WEATHER FAIR ☐ RAIN ☐ FOG ☐ CLOUDY ☐ SNOW ☐

TIME	MADE FULL STOP		FAILED TO STOP		TOTALS	
	NO INTERFERENCE	INTERFERENCE	NO INTERFERENCE	INTERFERENCE	VIOLATION	VOLUME
7 - 7:30						
7:30 - 8 -						
8 - 8:30						
[illegible] 9 -						
[illegible] - 9:30						
9:30 - 10 -						
10 - 10:30						
10:30 - 11 -						
11 - 11:30						
11:30 - 12 -						
12 - 12:30						
12:30 - 1 -						
1 - 1:30						
1:30 - 2 -						
2 - 2:30						
2:30 - 3 -						
3 - 3:30						
3:30 - 4 -						
4 - 4:30						
4:30 - 5 -						
5 - 5:30						
5:30 - 6 -						
6 - 6:30						
6:30 - 7 -						
TOTALS						
% VOLUME						

MASS DEP. PUBLIC SAFETY - HIGHWAY TRAFFIC RESEARCH

ONE SUMMARY EACH TYPE & DIRECTION

SPEED STUDY SUMMARY

220 APP HAZARD ☐ THRU HAZARD ☐ OPEN ROAD

LOCATION _____ AT _____

_____ MILE

TRAP LOCATED ON

STUDY TAKEN AT INTERSECTION ☐ DRIVE _____ ☐ MILE PT _____ ☐ CITY TAKEN ☐

RT _____ ST.

DIRECTION OF TRAVEL N S E W

PAVEMENT CODE _____ _____

THIS STUDY GOES WITH

1 2 3 4 APPROACH STUDIES

1 2 3 4 THRU STUDIES

1 2 3 4 OPEN ROAD STUDIES

PAVEMENT DRY ☐ WET ☐ ICE ☐ SNOW ☐

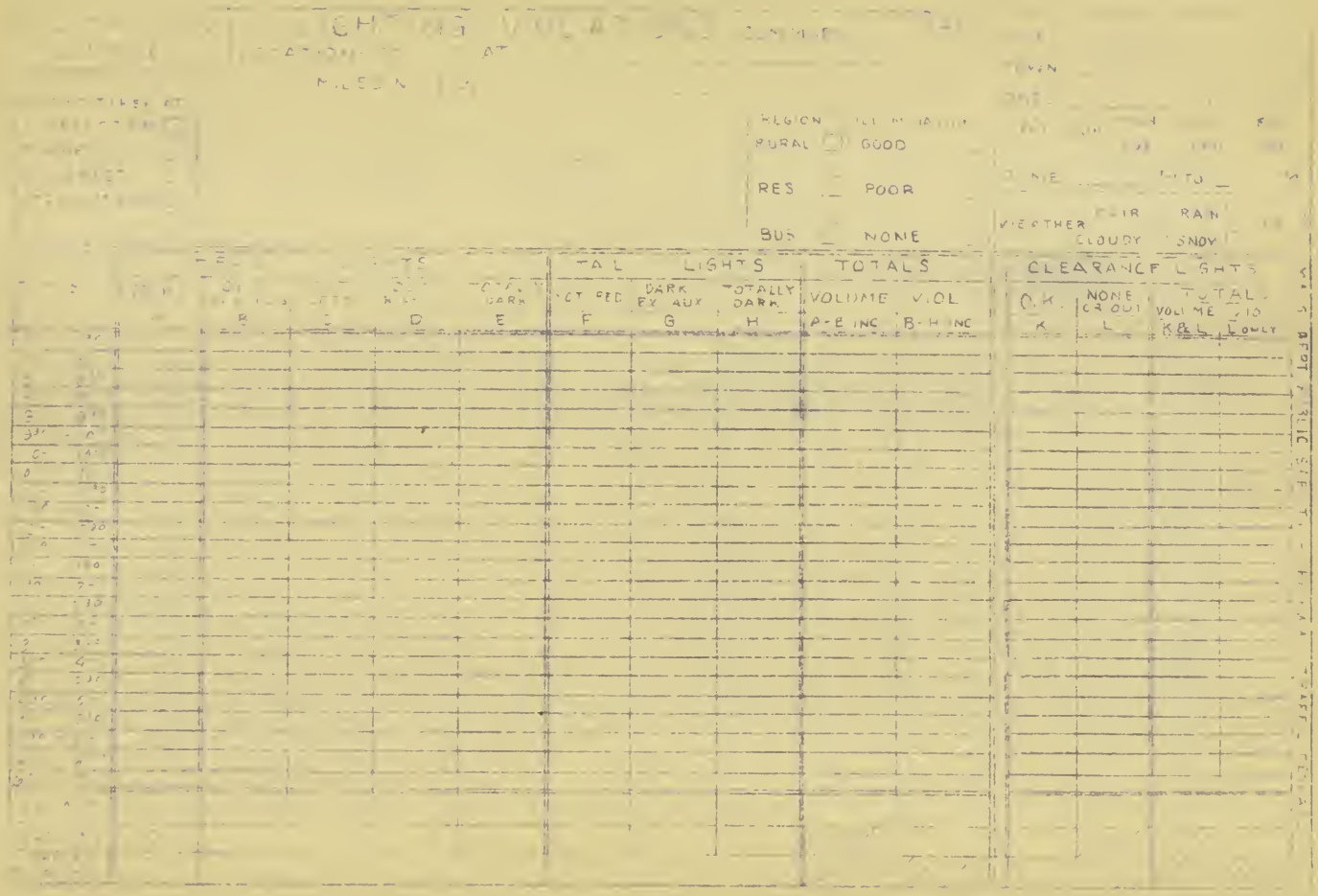
DAY SUN MON TUE WED THU FRI SAT

TIME _____

WEATHER CLEAR RAIN SNOW

TIME HALF HOUR PERIODS	NUMBER OF VEHICLES BY 5 MILE SPEED RANGES														TOTAL CARS CLOCKED	PRODUCTS A	PRODUCTS B
	UNDER 15	15-19.9	20-24.9	25-29.9	30-34.9	35 39.9	40 44.9	45-49.9	50 54.9	55 59.9	60-64.9	65-69.9	70 74.9	75 79.9	80 84.9	85- OVER			
TOTALS																			
% OF GRAND TOTAL																1000			
ACCUM. % LFT. TO RT.																			
ACCUM % RT. TO LFT.																			

MASS DEPT. OF PUBLIC SAFETY HIGHWAY TRAFFIC BUREAU


REGION
RURAL
GOOD
RES
POOR
BUS
NONE
WEATHER
CLOUDY
SNOW
TAIL LIGHTS
TOTALS
VOLUME
CLEARANCE LIGHTS
NONE
TOTAL
VOLUME

5

FIELD STUDY INDEX

HIGHWAY TRAFFIC RESEARCH 1936

CODE AREA	SITE No	LOCATION CITY OR TOWN	ROUTE INVOLVED	STUDY	DATE	DAY	TIME OF DAY MADE FROM	TIME OF DAY MADE TO	STUDY	DATE	DAY	TIME OF DAY MADE FROM	TIME OF DAY MADE TO

PAGE 3

TROOP AREA

LOCATION CODE INDEX

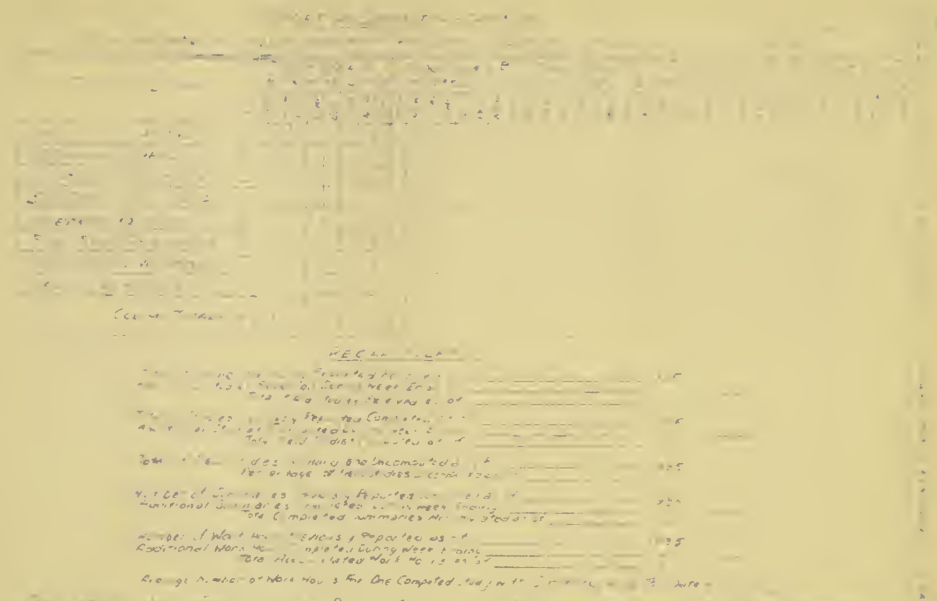
HIGHWAY TRAFFIC RESEARCH 1934 - 1935 - 1936

CODE AREA	CODE SITE NUMBER	SITE LOCATION TOWN OR CITY	ROUTES INVOLVED	DESCRIPTION OF SITE USED ON ALL STUDIES MADE AT THIS SITE	MAP ON FILE

SITE DESCRIPTION CODE INVENTORY

HIGHWAY TRAFFIC RESEARCH 1934 - 1936

SITE CODE	ROUTE	HAZARD	DESCRIPTION OF SITE	QUARTERS STUDIED 1	2	3	4	5	6	7	8



ACCESSION INVENTORY

SS	DATA			PRICE FIELD		WHEN STUDY WAS MADE			SUMMARY		REMARKS
	TOWN	POUCH NOS	DATE	DATE	NO OF DATA SHEETS	DATE	DAY	HOURS OVERED FROM — TO	NO OF	DATE FINAL	LAND CONDITIONS SEED ETC
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
			—	—		— —		M — M			
						—		M — M			
						—		M — M			
						—		M — M			
						—		M — M			
						—		M — M			

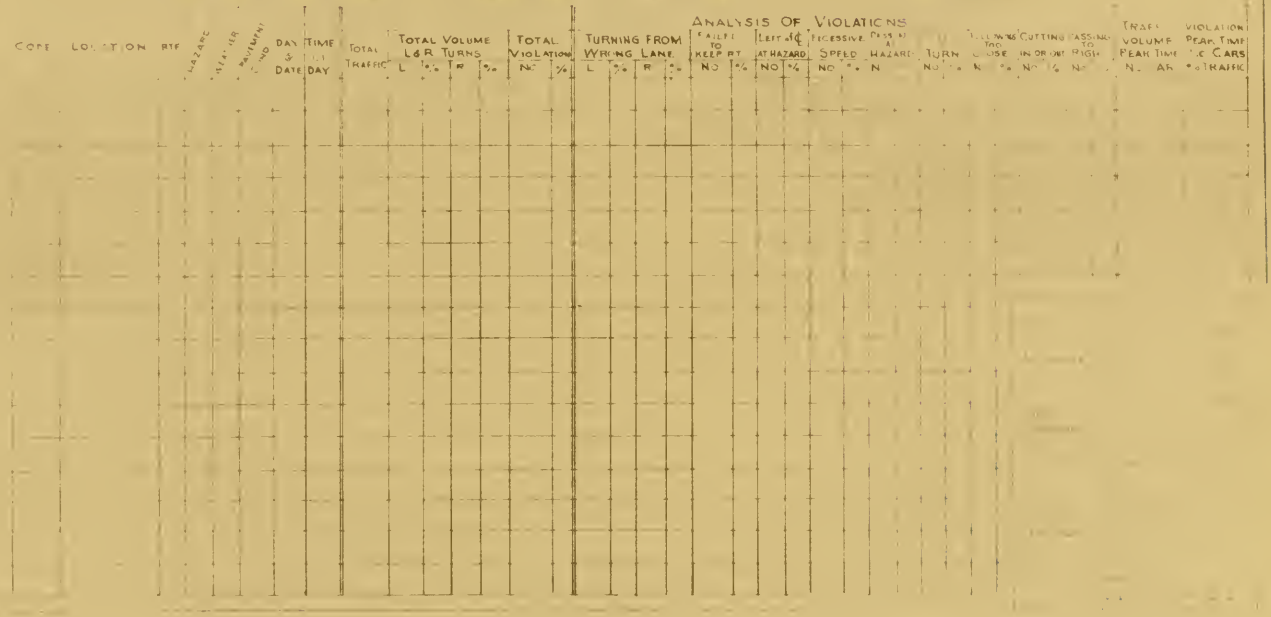
CONDENSED SUMMARY VEHICULAR VOLUME

A

CODE	LOCATION	RTE	DAY & DATE	TIME OF DAY	WEATHER	TYPE	LANES	COND	TOTAL TRAFFIC	NORTH	EAST	SOUTH	WEST	TIME	NO CARS
										NO	NO	NO	NO		
1284	NO. ATTLEBORO	1	TU 3/24	7-A 7-P	FAIR CLO	CON.	4	DRY	6679	3327	–	834	2518	4:30-5:30P	493 N
1339	PLAINVILLE	1	TH 4/16	7-A 7-P	FAIR CLO	CON.	4	DRY	4956	2446	123	2239	148	5-6P	318 N

	SYMBOL	CODE
WEATHER	FAIR	FAIR
	CLOUDY	CLO
	RAIN	RAIN
	SNOW	SNOW
CONDITION OF PAVEMENT	DRY	DRY
	WET	WET
	ICY	ICY
TYPE OF PAVEMENT	ASPHALT	ASP
	CONCRETE	CON
	DUAL	D
	DIVIDED	S
	MACADAM	MAC

CONDENSED SUMMARY — DRIVING VIOLATIONS — TROOP ____



CONDENSED SUMMARY VEHICULAR TRAFFIC SIGNAL OBEDIENCE

C

CODE	TOWN	RTE	EXACT LOCATION	DATE	M	F	VIOLATION: ENTERED RED NO	%	ENTERED FAILING RED NO	%	CAUSING RED											CODE
			J'CT'N TU 7-A FAIRDRY																			
1006	MILFORD	126	RTE-140 3/31 1-P CLO																			
				N	-	-	-	-	1	.74	3	.22	29	21.5	33	135	24.4					
				E	-	-	-	-	1	.17	6	1.03	57	9.79	64	582	10.99					
				S	-	-	-	-	2	1.1	1	.55	17	9.39	20	181	11.04					
				W	4	.58	-	-	1	.14	2	.29	27	3.90	34	693	4.91					

	SYMBOL	CODE
WEATHER	FAIR	FAIR
	CLOUDY	CLOU
	RAIN	RAIN
	SNOW	SNOW
CONDITION OF PAVEMENT	DRY	DRY
	WET	WET
	ICY	ICY

CONDENSED SUMMARY-PEDESTRIAN TRAFFIC SIGNAL OBEDIENCE

- TROOP-A

CODE	TOWN	EXACT LOCATION	ROUTE	DATE	TIME OF DAY	WEATHER	TOTAL TRAFFIC	TOTAL VIOLATIONS NUMBER	TOTAL VIOLATIONS %	REMARKS
1277	ARLINGTON	SO. J'CTN RT 60 MASS. AVE	3	FRI 3/27	7-A 1-P	CLO	246	149	60.57	WEST OF J'CTN
1277	"	"	3	"	"	"	573	463	80.80	EAST " "
1277	"	"	3	"	"	"	1015	668	79.67	" " "
1277	"	BROADWAY EA. OF J'NCTN	3	"	1-P 7-P	FAIR	1330	466	35.04	BROADWAY EAST OF "
1277	"	"	3	"	"	"	1442	534	37.04	MASS. AVE EAST OF "
1277	"	"	3	"	"	"	2166	1556	71.84	WEST " "

	SYMBOL	CODE
WEATHER	FAIR	FAIR
	CLOUDY	CLO
	RAIN	RAIN
	SNOW	SNOW

CONDENSED SUMMARY

STOP SIGN OBSERVANCE

TROOP A DAY

CODE	LOCATION	ROUTE	DATE & TIME OF DAY	WEATHER	TYPE OF INTERSECTION	PAVEMENT TYPE	PAVEMENT COND	DIRECTION	TOTAL TRAFFIC	MADE FULL STOP NO INT. NO	NO INT. %	INT NO	INT %	TOTAL VIOL NO	TOTAL VIOL %	FAILED TO STOP NO INT NO	NO INT %	INT NO	INT %
4360	WALTHAM	128	WED 4-8 7A-1P	FAIR	Y	A	DRY	N	522	50	15.5	11	3.4	61	18.9	50	77.7	11	3.4
4360	"	128	TH 4-9 7-7P	"	Y	A	DRY	N	575	72	13.2	48	8.8	120	22.0	53	73.4	6	6.4

	SYMBOL	CODE
WEATHER	FAIR	FAIR
	CLOUDY	CLOU
	RAIN	RAIN
	SNOW	SNOW
CONDITION OF PAVEMENT	DRY	DRY
	WET	WET
	ICY	ICY
TYPE OF PAVEMENT	ASPHALT	ASPH
	CONCRETE	CONC
	BRICK	B
	MACADAM	MAC
	OTHER	O
TYPE OF INTERSECTION	Y TYPE	Y
	T TYPE	T

5 MILE SPEED RANGE SUMMARY

TROOP A ___ DAYS ___ ___ ___ ___ ___ ___

CODE	PIL LOCATION	HAZARD	DATE	TIME OF DAY AM	TIME OF DAY PM	WEATHER	PAVEMENT TYPE	PAVEMENT LINES	TOTAL TRAFFIC	TOTAL NO OF CARS OBS	ANALYSIS of SPEED MILES PER HOUR — UNDER 15 MPH (No, %)	15 19 9 MPH (No, %)	20 24 9 MPH (No, %)	25 29 9 MPH (No, %)	30 34 9 MPH (No, %)	35 39 9 MPH (No, %)	40 44 9 MPH (No, %)	45 49 9 MPH (No, %)	50 54 9 MPH (No, %)	55 59 9 MPH (No, %)	60 64 9 MPH (No, %)	65 69 9 MPH (No, %)	70 74 9 MPH (No, %)	75 79 9 MPH (No, %)	80 84 9 MPH (No, %)	85 + MPH (No, %)	PRODUCTS	AVG SPEED
11	SHARON	STR	5/21		P	FAIR	C	4	DIV	2350	2284	N	-	-	1	.1	7	.3	21	.9	56	24	38	6	1	336	M	196	21	55	12	4	3	36	1	6	1	195	85	79	35	24	11	5	2	2	1	113217	49.6
11	"	STR	"				C	4	"	1377	1323	S	-	-	1	.1	4	.3	23	1.7	70	53	62	12	3	29	9	220	27	1	20	5	2	9	2	2	5	1	08	27	75	8	12	9	5	4				60912	46.0

	SYMBOL	CODE
WEATHER	FAIR	FAIR
	CLOUDY	CLD
	RAIN	RAIN
	SNOW	SNOW
CONDITION OF PAVEMENT	DRY	DRY
	WET	WET
	ICY	ICY
TYPE OF PAVEMENT	ASPHALT	ASP
	CONCRETE	CON
	D.A.	D
	DIVIDED	A
	MACADAM	MAC
TYPE OF HAZARDS	INTERSECTION	INT
	CURVE	CURVE
	HILL CREST	HILL
	STRAIGHTAWAY	STRA
	BRIDGE	BRIDGE
	TRAFFIC LIGHT	T L
	OVERPASS	O P
	UNDERPASS	U P
	R R CROSSING	R R

ACCIDENT RECORD

LOCAL
STATE POLICE RECORD - 193 TOWN OF TROOP

	ROUTE	LOCATION	TIME OF DAY						DAY OF WEEK							MONTH												RESULT			PEAK HOURS				FATAL		VEHICLE INVOLVED		
			A.M.		9AM TO 4PM	P.M.																									7-9 A.M.		4-6 PM						
			12-7	7-9		4-6	6-12		SUN	MON	TUE	WED	THUR	FRI	SAT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	K	J	P	K	J	K	J	DAY	NIGHT	P	T	B
1																																							
2																																							
3																																							
4																																							
5																																							
6																																							
7																																							
8																																							
9																																							
10																																							
11																																							
12																																							
13																																							
14																																							

FORM 2

ACCIDENT RECORD

LOCAL
STATE POLICE RECORD - 193

TOWN OF

TROOP

	TYPE OF ACCIDENT	HAZARD	WEATHER	ROAD CONDITION	TRAFFIC CONTROL	TYPE OF DISTRICT	PEDESTRIAN		CAUSES												DRIVER						S. H.
							ADULT	CHILD	RECK-LESS DRIVER	DRUNK DRIVER	SPEED	SKID	FAIL TO KEEP RIGHT	BLOW OUT	GLARE LIGHTS	OBSTR. VISION	CARE-LESS PED.	CUT IN	MISC.	HIT & RUN	NATION-ALITY	OUT OF STATE CAR	AGE	YEARS OF DRIVING	CAR CONDI-TION	FILE OR CASE NO.
																											F. C.
1																											
2																											
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											
11																											
12																											
13																											
14																											

COMBINED LOCAL AND STATE POLICE ACCIDENT RECORD
FOR STATE AND NUMBERED ROUTES ONLY
MASSACHUSETTS
FIRST QUARTER 1936

JANUARY 1 - MARCH 31, 1936
(Page 1 of 2)

		TROOP AREAS				
		A	B	C	D	TOTAL
RESULTS	Number of Accidents	672	395	266	296	1629
	Number Killed	20	11	10	9	50
	Number Injured	843	278	279	309	1709
	Number Property Damage	148	190	82	83	503
CAUSES	Drunken Driver	40	25	19	24	108
	Reckless Driver	214	68	32	137	451
	Speed	82	77	53	22	234
	Skid	134	115	65	54	368
	Fail to Keep Right	23	20	23	5	71
	Blow Out	3	0	1	3	7
	Glaring Lights	7	4	4	2	17
	Obstructed Vision	24	11	6	2	43
	Cut In	32	3	5	3	43
	Careless Pedestrian	103	51	44	35	233
	Miscellaneous	10	21	14	9	54
KILLED	Day-time	6	2	3	1	12
	Night-time	14	9	7	8	38
PEAK HOURS	Killed Between 7 AM-9 AM	2	0	0	0	2
	Injured " 7 AM-9 AM	52	14	7	33	106
	Killed " 4 PM-6 PM	1	2	0	2	5
	Injured " 4 PM-6 PM	112	54	63	35	264
TIME OF DAY	Accidents 12 PM-7 AM	84	40	25	34	183
	" 7 AM-9 AM	51	25	13	24	113
	" 9 AM-4 PM	210	130	87	87	514
	" 4 PM-6 PM	91	68	56	37	252
	" 6 PM-12PM	225	122	74	111	532
	" Not Recorded	11	10	11	3	35
DAY OF WEEK	Sunday Accidents	93	78	51	49	271
	Monday "	78	34	32	32	176
	Tuesday "	95	55	31	45	226
	Wednesday "	105	36	30	44	215
	Thursday "	83	61	31	38	213
	Friday "	113	62	35	48	258
	Saturday "	105	69	56	40	270
MONTH	January Accidents	238	134	87	126	585
	February "	238	154	102	92	586
	March "	196	107	77	78	458
	Hit and Run Accidents	13	14	8	11	46
	Pedestrians Involved - Adults	132	51	39	50	272
	Pedestrians Involved - Children	58	35	17	29	139
	Pedestrians Involved - Not Classified	1	1	0	0	2

COMBINED LOCAL AND STATE POLICE ACCIDENT RECORDS
FOR STATE AND NUMBERED ROUTES ONLY
MASSACHUSETTS
FIRST QUARTER 1936

806

JANUARY 1 - MARCH 31, 1936
(Page 2 of 2)

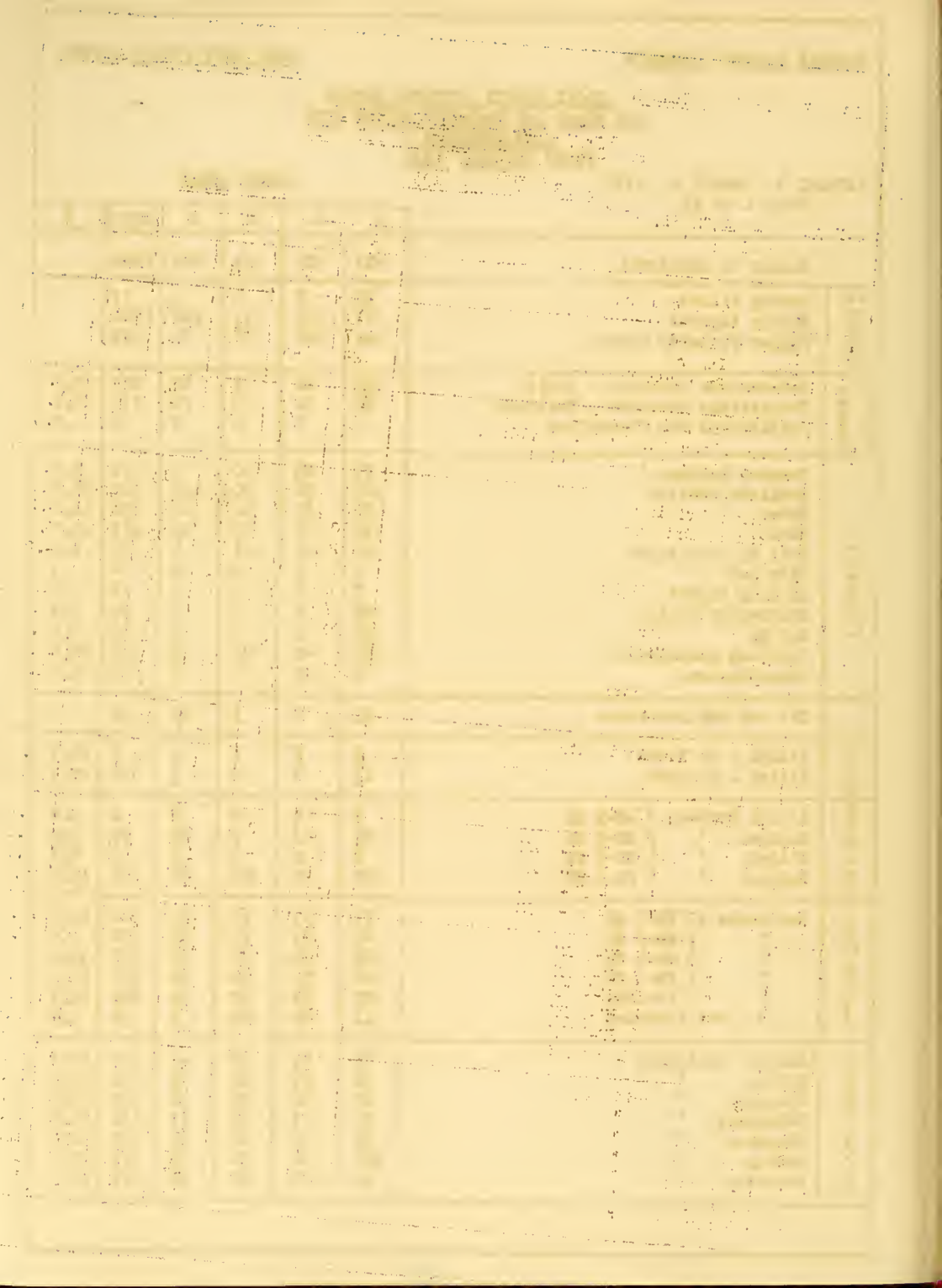
		TROOP AREAS				
		A	B	C	D	TOTAL
VEHICLES INVOLVED	Passenger Car	900	530	368	380	2178
	Truck	202	132	80	75	489
	Bus	20	9	11	5	45
	Street Car	1	3	1	1	6
	Horse Drawn Vehicle	3	1	4	5	13
	Taxi	0	0	0	0	0
	Motor Cycle	0	0	0	0	0
	Train	3	0	0	0	3
	Bicycle	1	3	0	7	11
	Miscellaneous	1	1	0	0	2
HAZARD	Intersection	274	144	67	94	579
	Straightaway	318	166	144	176	804
	Curve	37	54	43	22	156
	Hill	21	14	11	2	48
	Miscellaneous	11	9	0	2	22
	Not Recorded	11	8	1	0	20
TRAFFIC CONTROL	Stop and Go Light	65	28	5	13	111
	Beacon	16	6	1	5	28
	Officer	1	1	0	0	2
	Stop Sign	22	5	4	9	40
	Warning Sign	0	3	1	1	5
	Not Recorded & Miscellaneous	568	352	255	268	1443
DISTRICT	Business	169	82	50	52	353
	Residential	305	218	109	139	771
	Country	194	95	104	91	484
	Not Recorded	4	0	3	14	21
WEATHER	Clear	365	185	146	204	900
	Cloudy	34	6	22	9	71
	Rain, Snow	109	69	37	43	258
	Fog, Mist, Sleet	24	14	16	13	67
	Not Recorded	140	121	45	27	333
ROAD CONDITION	Dry	188	64	66	108	426
	Wet	89	34	36	38	197
	Snow	60	46	36	22	164
	Ice	205	158	106	107	576
	Not Recorded	130	93	22	21	266
	Foreign Drivers	188	291	201	160	840
	Out of State Cars	40	57	30	49	176
	Female Drivers	76	47	34	42	199

LOCAL POLICE ACCIDENT RECORD
FOR STATE AND NUMBERED ROUTES ONLY
MASSACHUSETTS
FIRST QUARTER 1936

807

JANUARY 1 - MARCH 31, 1936
(Page 1 of 2)

		TROOP AREAS					
		A	B	C	D	TOTAL	%
	Number of Accidents	607	309	191	245	1352	
RESULTS	Number Killed	19	9	6	3	37	
	Number Injured	747	214	193	264	1418	
	Number Property Damage	124	144	56	65	389	
PEDESTRIAN RESULTS	Pedestrians Involved - Adults	129	48	35	42	254	65.3
	Pedestrians Involved - Children	58	32	15	28	133	34.2
	Pedestrians Not Classified	1	1	0	0	2	.5
CAUSES	Drunken Driving	33	15	10	13	71	5.3
	Reckless Driving	206	51	20	128	405	30.0
	Speed	70	68	42	16	196	14.4
	Skid	112	36	43	40	281	20.7
	Fail to Keep Right	21	14	18	4	57	4.2
	Blow Out	2	0	0	2	4	.3
	Glaring Lights	7	4	4	1	16	1.2
	Obstructed Vision	20	8	2	2	32	2.4
	Cut In	29	0	5	1	35	2.6
	Careless Pedestrian	101	48	41	31	221	16.4
	Miscellaneous	6	15	6	7	34	2.5
	Hit and Run Accidents	13	7	3	10	33	
KILLED	Killed - In Light	6	2	1	0	9	24.3
	Killed - In Dark	13	7	5	3	28	75.7
PEAK HOURS	Killed Between 7 AM-9 AM	2	0	0	0	2	5.4
	Injured " 7 AM-9 AM	50	12	7	30	99	7.0
	Killed " 4 PM-6 PM	1	2	0	0	3	8.1
	Injured " 4 PM-6 PM	103	39	54	30	226	15.9
TIME OF DAY	Accidents 12 PM-7 AM	71	33	15	29	148	10.9
	" 7 AM-9 AM	48	21	10	22	101	7.5
	" 9 AM-4 PM	186	94	58	70	408	30.2
	" 4 PM-6 PM	86	52	46	32	216	16.0
	" 6 PM-12PM	205	99	52	89	445	32.9
	" Not Recorded	11	10	10	3	34	2.5
DAY OF WEEK	Sunday Accidents	78	65	35	41	219	16.2
	Monday "	76	26	21	25	148	11.0
	Tuesday "	87	46	24	38	195	14.4
	Wednesday "	93	27	24	37	181	13.4
	Thursday "	72	49	21	31	173	12.7
	Friday "	107	41	24	39	211	15.6
	Saturday "	94	55	42	34	225	16.7



LOCAL POLICE ACCIDENT RECORD
FOR STATE AND NUMBERED ROUTES ONLY
MASSACHUSETTS
FIRST QUARTER 1936

808

JANUARY 1 - MARCH 31, 1936
(Page 2 of 2)

		TROOP AREAS					
		A	B	C	D	TOTAL	%
MONTH	January Accidents	215	102	58	106	481	35.5
	February "	207	122	78	80	487	36.2
	March "	185	85	55	59	384	28.5
VEHICLES INVOLVED	Passenger Cars	812	423	264	312	1811	80.5
	Trucks	168	93	47	63	371	16.5
	Bus	18	9	9	4	40	1.8
	Motor Cycle	0	0	0	0	0	.0
	Bicycle	1	2	0	5	8	.3
	Train	2	0	0	0	2	.1
	Trolley	1	3	1	1	6	.2
	Horse Drawn Vehicle	3	1	3	5	12	.5
	Taxi	0	0	0	0	0	.0
	Steam Roller	0	0	0	0	0	.0
	Miscellaneous	1	1	0	0	2	.1
HAZARD	Straightaway	282	120	104	145	651	43.2
	Intersection	260	130	54	82	526	33.8
	Curve	32	34	28	17	111	8.2
	Hill	14	10	4	0	23	2.1
	Miscellaneous	8	7	0	1	16	1.2
	Not Recorded	11	8	1	0	20	1.5
TRAFFIC CONTROL	Stop & Go	61	28	5	13	107	
	Stop Signs	21	4	4	8	37	
	Beacons	13	6	1	4	24	
	Officer	1	1	0	0	2	
	Warning Signs	0	3	0	1	4	
	Misc. and Not Recorded	511	267	181	219	1178	
DISTRICT	Business	166	74	46	52	338	25.0
	Residential	236	182	80	119	667	49.3
	Country	151	53	62	60	326	24.1
	Not Recorded	4	0	3	14	21	1.6
WEATHER	Clear	324	130	92	168	714	52.8
	Cloudy	29	4	19	5	57	4.2
	Rain, Snow	93	42	27	37	199	14.7
	Fog, Mist, Sleet	21	12	8	8	49	3.6
	Not Recorded	140	121	45	27	333	24.7
CONDITION OF ROAD	Dry	169	45	42	82	338	25.0
	Wet	83	25	24	33	165	12.2
	Snow	55	33	26	19	133	9.9
	Ice	170	113	77	90	450	33.2
	Not Recorded	130	93	22	21	266	19.7
	Foreign Drivers	160	259	163	128	710	
	Out of State Cars	24	29	7	39	99	
	Female Drivers	69	36	26	34	165	

HIGHWAY TRAFFIC RESEARCH — MASS. DEPT. PUBLIC SAFETY

STATE POLICE ACCIDENT RECORD

FOR STATE AND NUMBERED ROUTES ONLY

811

MASSACHUSETTS

FIRST QUARTER 1936

JANUARY 1 - MARCH 31, 1936

(Page 1 of 2)

		TROOP AREAS				
		A	B	C	D	TOTAL
RESULTS	Number of Accidents	65	87	75	51	278
	Number Killed	1	2	4	6	13
	" Injured	96	71	86	45	298
	" Property Damage	24	46	26	18	114
PEDESTRIAN RESULTS	Pedestrians Involved - Adults	3	3	4	8	18
	" Killed - "	0	1	0	4	5
	" Injured - "	3	2	4	4	13
	Pedestrians Involved - Children	0	3	2	1	6
	" Killed - "	0	0	1	0	1
	" Injured - "	0	3	1	1	5
CAUSES	Drunken Driving	7	10	9	11	37
	Reckless Driving	8	17	12	9	46
	Speed	12	9	11	6	38
	Skid	22	29	22	14	87
	Fail to Keep Right	2	7	5	1	15
	Blow Out	1	0	1	1	3
	Glaring Lights	0	0	0	1	1
	Obstructed Vision	4	3	4	0	11
	Cut In	3	3	0	2	8
	Careless Pedestrian	2	3	3	4	12
	Miscellaneous	4	6	8	2	20
	Hit and Run Accidents	0	7	5	1	13
KILLED	Killed In Light	0	0	2	1	3
	Killed In Dark	1	2	2	5	10
PEAK HOURS	Killed Between 7 AM-9 AM	0	0	0	0	0
	Injured " 7 AM-9 AM	2	2	0	3	7
	Killed " 4 PM-6 PM	0	0	0	2	2
	Injured " 4 PM-6 PM	9	15	9	5	38
TIME OF DAY	Accidents 12 PM-7 AM	13	7	10	5	35 *
	" 7 AM-9 AM	3	4	3	2	12
	" 9 AM-4 PM	24	36	29	17	106
	" 4 PM-6 PM	5	16	10	5	36
	" 6 PM-12PM	20	24	22	22	88
DAY OF WEEK	Sunday Accidents	15	13	16	8	52
	Monday "	2	8	11	7	28
	Tuesday "	8	10	7	7	32
	Wednesday "	12	9	6	7	34
	Thursday "	11	12	10	7	40
	Friday "	6	21	11	9	47
	Saturday "	11	14	14	6	45

* Time not given in one accident in Troop C

HIGHWAY TRAFFIC RESEARCH — MASS. DEPT. PUBLIC SAFETY

STATE POLICE ACCIDENT RECORD

812

FOR STATE AND NUMBERED ROUTES ONLY

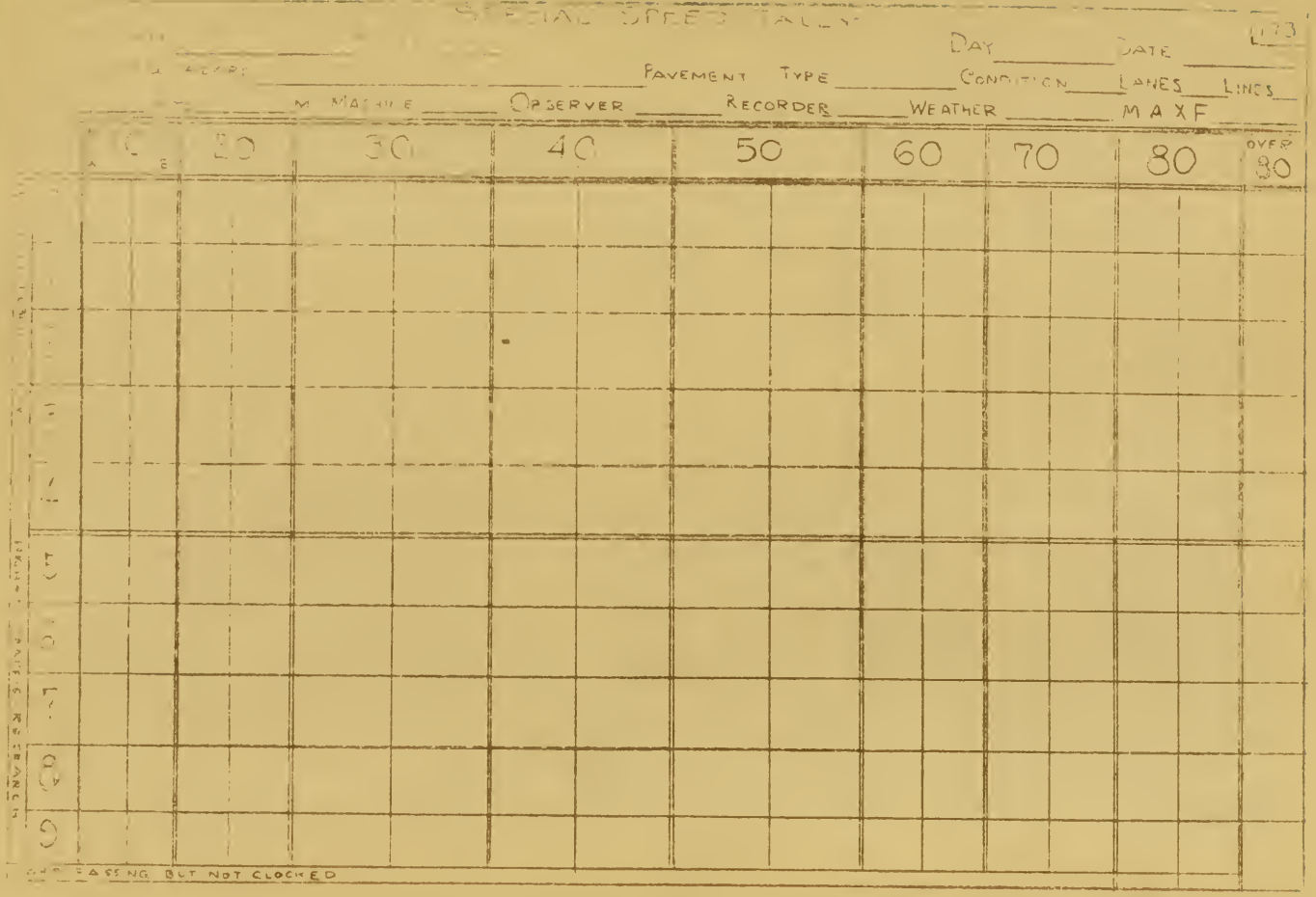
MASSACHUSETTS

FIRST QUARTER 1936

JANUARY 1 - MARCH 31, 1936

(Page 2 of 2)

		TROOP AREAS				
		A	B	C	D	TOTAL
MONTH	January Accidents	23	32	29	20	104
	February "	31	32	24	12	99
	March "	11	23	22	19	75
VEHICLES INVOLVED	Passenger Car	88	109	104	68	369
	Trucks	34	39	33	12	118
	Bus	2	0	2	1	5
	Motorcycle	0	0	0	0	0
	Bicycle	0	1	0	2	3
	Train	1	0	0	0	1
	Trolley	0	0	0	0	0
	Horse Drawn Vehicle	0	0	1	0	1
HAZARD	Straightaway	36	47	40	31	154
	Intersection	14	14	13	12	53
	Curve	5	20	15	5	45
	Hill	7	4	7	2	20
	Railroad Crossing	2	0	0	0	2
	Bridge	0	1	0	1	2
	Underpass	1	1	0	0	2
	Miscellaneous	0	0	0	0	0
TRAFFIC CONTROL	Stop & Go	4	0	0	0	4
	Stop Signs	1	1	0	1	3
	Beacons	3	0	0	1	4
	Officer	0	0	0	0	0
	Warning Signs	0	0	1	0	1
DISTRICT	Business	3	8	4	0	15
	Residential	19	36	29	20	104
	Country	43	43	42	31	159
WEATHER	Clear	41	56	54	36	187
	Cloudy	5	2	3	4	14
	Rain - Snow	16	27	10	6	59
	Fog - Mist - Sleet	3	2	8	5	18
	Not Recorded	0	0	0	0	0
CONDITION OF ROAD	Dry	19	20	24	26	89
	Wet	6	9	12	5	32
	Snow	5	13	10	3	31
	Ice	35	45	29	17	126
	Miscellaneous	0	0	0	0	0
	Not Recorded	0	0	0	0	0
	Foreign Drivers	28	32	38	32	130
	Out of State Cars	16	28	23	10	77
	Female Drivers	7	11	8	8	34


SPECIAL SPEED TALLY
DAY
DATE
PAVEMENT TYPE
CONDITION
LANES
LINES
M MACHINE
OBSERVER
RECORDER
WEATHER
M A X F
20
30
40
50
60
70
80
OVER 80
PASSING BUT NOT CLOCKED

SPEED RANGE & AVERAGE SPEED WORK SHEET 31A

BY	DATE

TOWN _____ LOCATION MAXF _____

DATE ___ DAY ___ TIME _____ BOUND ___ MCH. D _____

MILES PER HOUR

	0	10	20	30	40	50	60	70	80	90
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										
CAR MILES										

NUMBER OF CARS

MAKING TURNS

STOPPED FOR LIGHTS

GOING ACROSS

TOTAL TRAFFIC VOLUME

MAXIMUM SPEED

AVERAGE SPEED

MASSACHUSETTS DEPARTMENT OF PUBLIC SAFETY HIGHWAY TRAFFIC RESEARCH

SPEED RANGE SUMMARY SHEET

TOWN _____ TROOP AREA _____ ROUTE _____

EXACT LOCATION _____

HAZARD _____ LANES ____ PAVEMENT _____

CONDITION PAVEMENT _____ WEATHER _____

CODE MAXF.

DAY _____

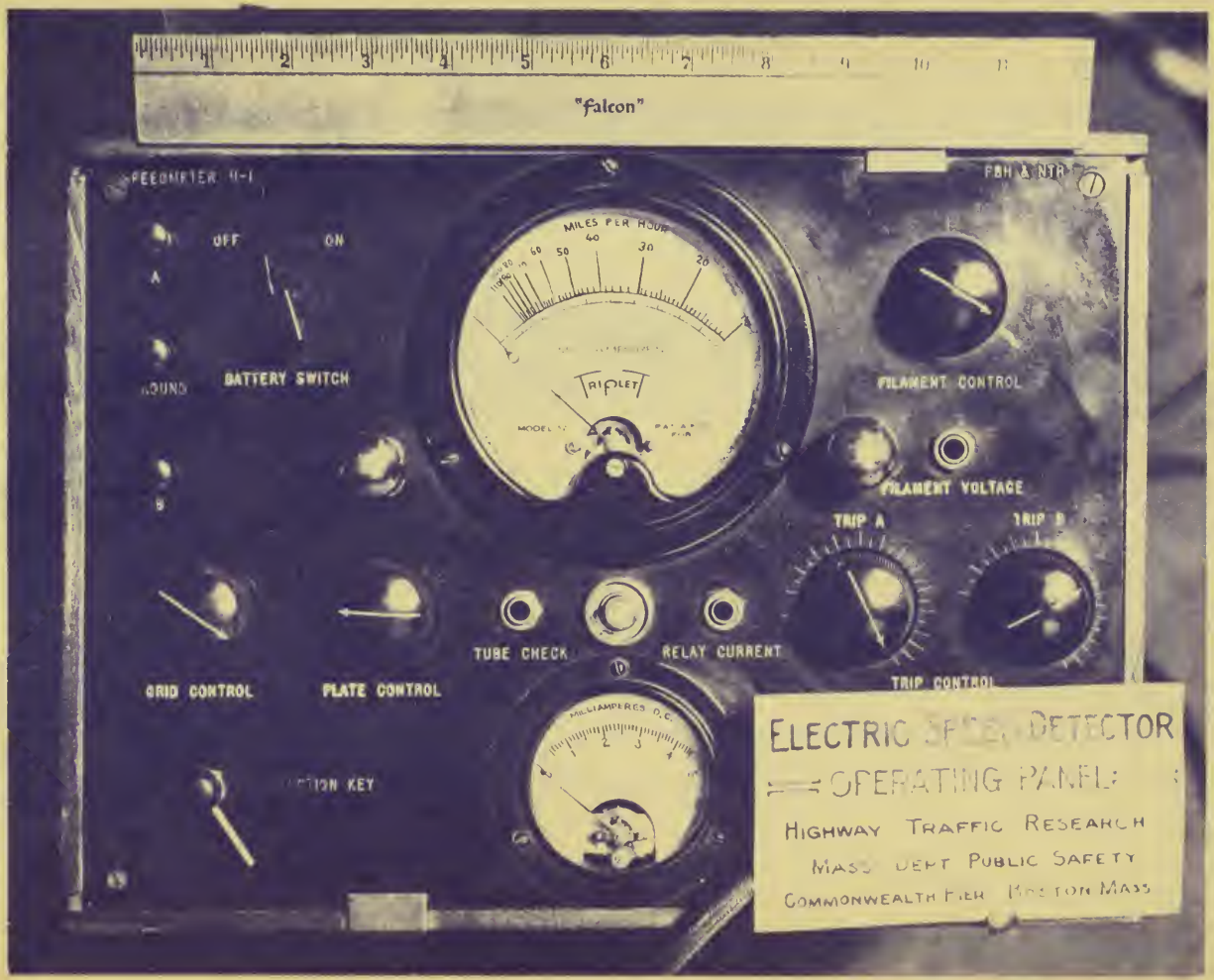
DATE _____

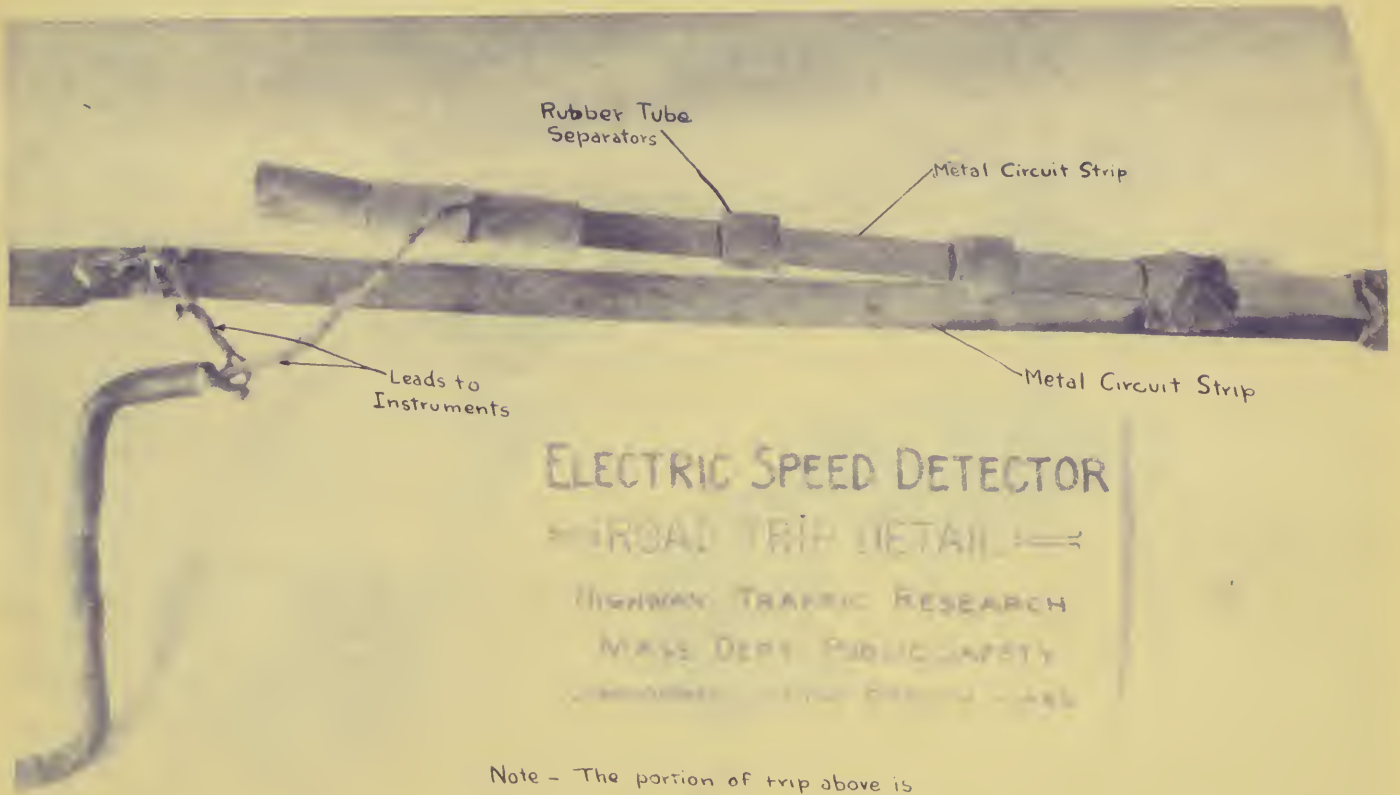
TIME FROM _____

TO _____

SPEED RANGE MILES PER HOUR	NUMBER OF CARS IN HALF HOURLY PERIODS BOUND												SUB TOTAL CLOCKED	% TOTAL CLOCKED	ACCUMU-LATIVE %
Under 10															
10 to 14.9															
15 to 19.9															
20 to 24.9															
25 to 29.9															
30 to 34.9															
35 to 39.9															
40 to 44.9															
45 to 49.9															
50 to 54.9															
55 to 59.9															
60 to 64.9															
65 to 69.9															
70 to 74.9															
75 to 79.9															
80 or More															
Cars Clocked															
Total Traffic															
% " Checked															
Car Miles															
Average Speed															
Maximum Speed															

ELECTRIC SPEED DETECTOR

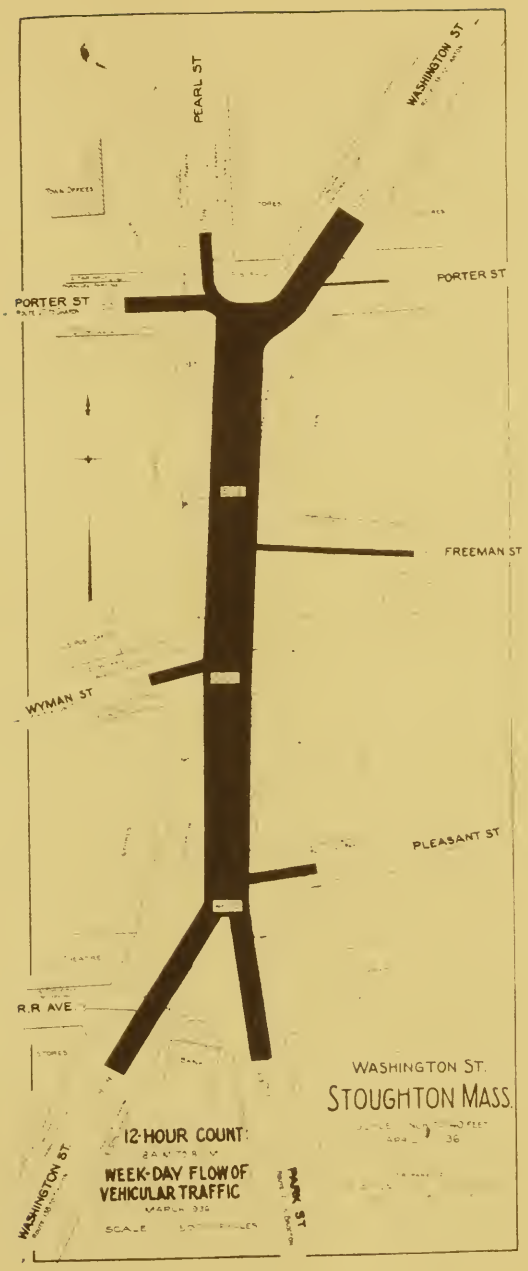

"falcon"
OFF
ON
BATTERY SWITCH
MILES PER HOUR
TRIPLETT
FILAMENT CONTROL
FILAMENT VOLTAGE
TRIP A
TRIP B
TRIP CONTROL
TUBE CHECK
RELAY CURRENT
GRID CONTROL
PLATE CONTROL
MILLIAMPERES D.C.
ELECTRIC SPEED DETECTOR
OPERATING PANEL
HIGHWAY TRAFFIC RESEARCH
COMMONWEALTH PIER BOSTON MASS



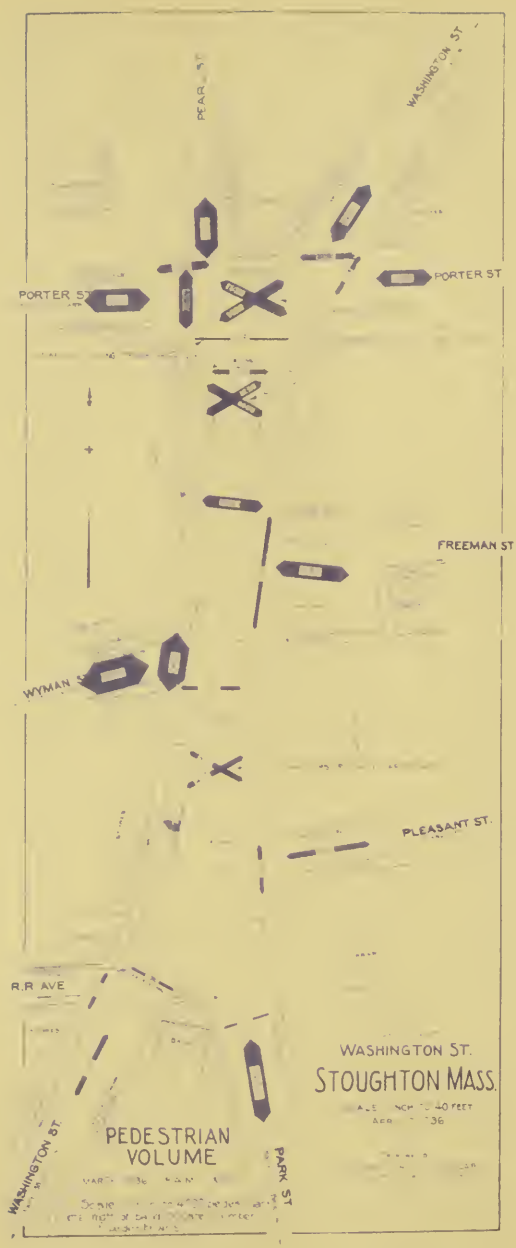
ELECTRIC SPEED DETECTOR
ROAD TRIP DETAIL
HIGHWAY TRAFFIC RESEARCH
MASS DEPT PUBLIC SAFETY

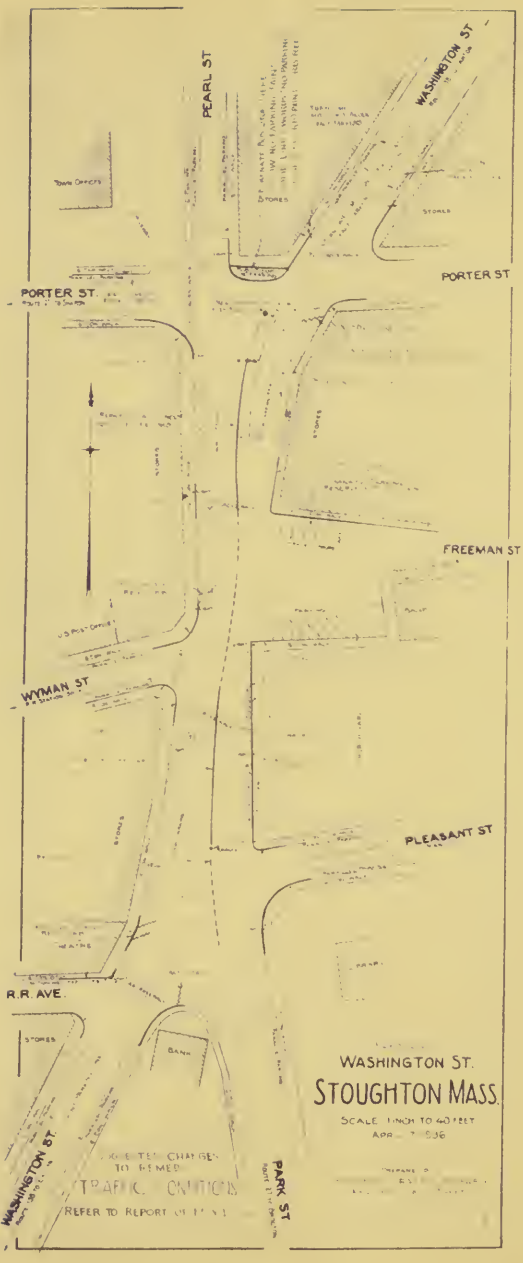
Note - The portion of trip above is uncovered to show assembly. All is covered with rubber tape and insulating compound when in use.

HUGHES SPEED SCOPE
FOR ESTABLISHING VARIABLE
SPEED TRAPS WITHOUT ELECTRICAL SETUP
HIGHWAY TRAFFIC RESEARCH
MASS. DEPT. PUBLIC SAFETY
COMMONWEALTH PIER BOSTON MASS.


PEARL ST
WASHINGTON ST
PORTER ST
PORTER ST
FREEMAN ST
WYMAN ST
PLEASANT ST
R.R AVE
WASHINGTON ST.
STOUGHTON MASS.
12-HOUR COUNT
WEEK-DAY FLOW OF
VEHICULAR TRAFFIC
WASHINGTON ST

PEARL ST
WASHINGTON ST
PORTER ST
PORTER ST
FREEMAN ST
WYMAN ST
PLEASANT ST
R R AVE
WASHINGTON ST
STOUGHTON MASS
VOLUME AND
MOVEMENT OF
VEHICULAR TRAFFIC
WASHINGTON ST
PARK ST


PEARL ST
WASHINGTON ST
PORTER ST
PORTER ST
FREEMAN ST
WYMAN ST
PLEASANT ST
R.R. AVE
WASHINGTON ST.
STOUGHTON MASS.
PEDESTRIAN
VOLUME
WASHINGTON ST.
PARK ST


PEARL ST
WASHINGTON ST
PORTER ST
PORTER ST
FREEMAN ST
WYMAN ST
PLEASANT ST
R.R. AVE.
WASHINGTON ST
PARK ST
WASHINGTON ST.
STOUGHTON MASS.
SCALE 1 INCH TO 40 FEET
TRAFFIC CONTROLS
REFER TO REPORT